# SCIENTIFIC AMERICAN

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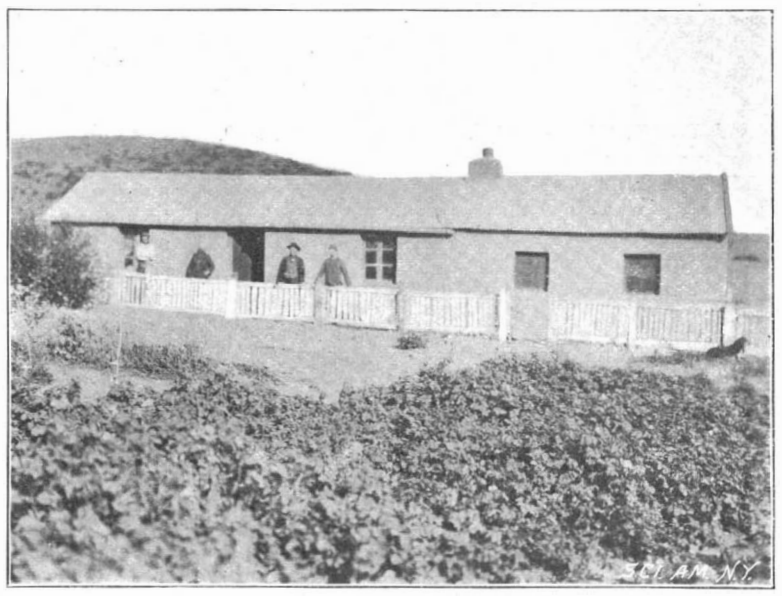
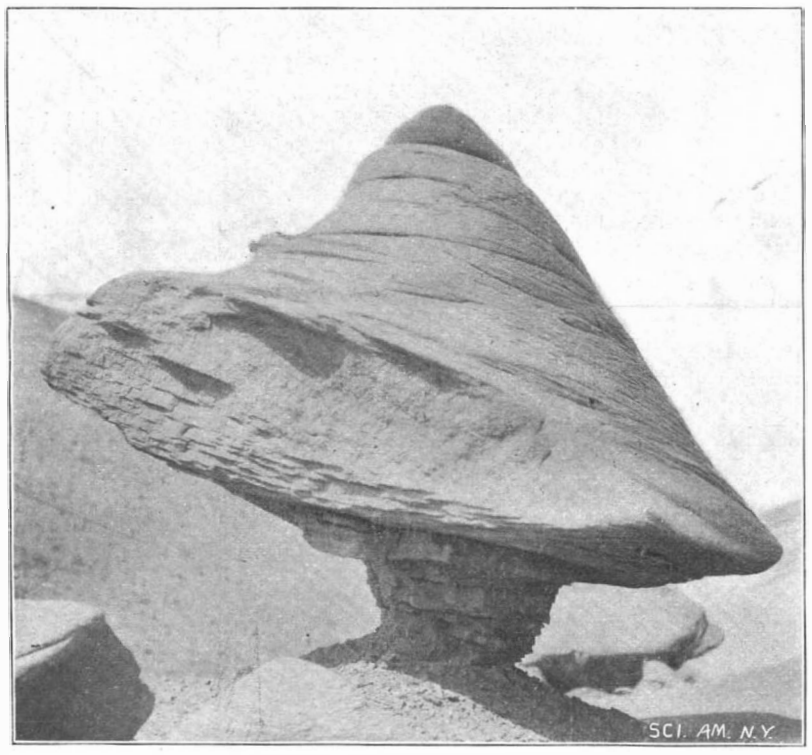
$3.00 A YEAR.
WEEKLY.

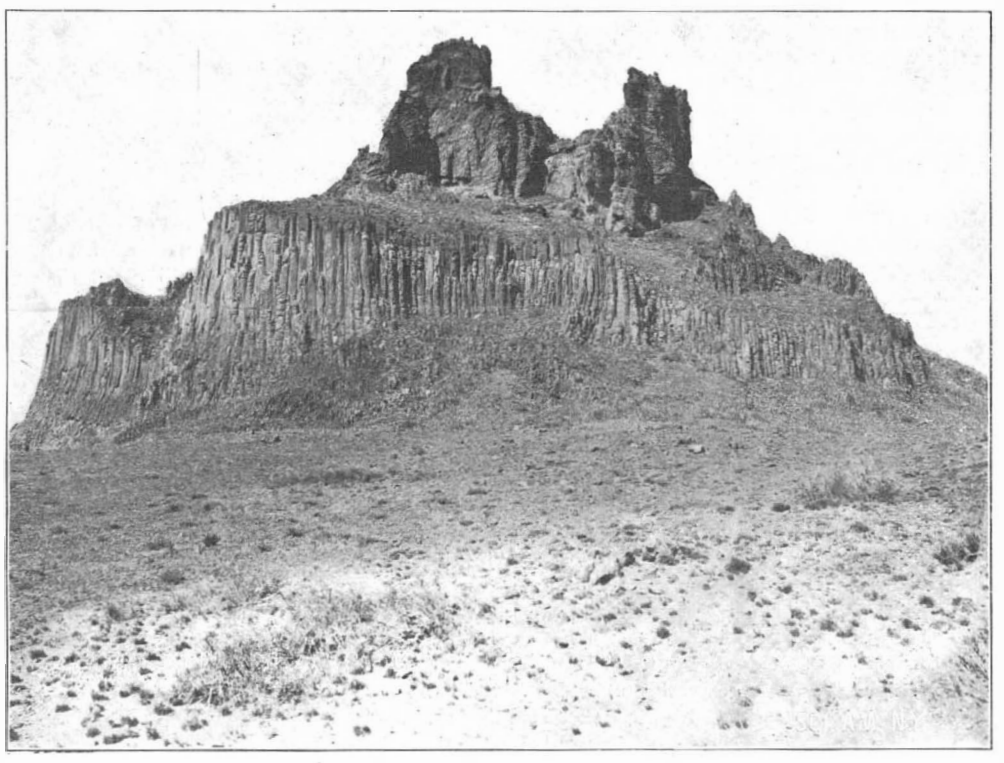
Group of Tehnelches with Two White Argentines.



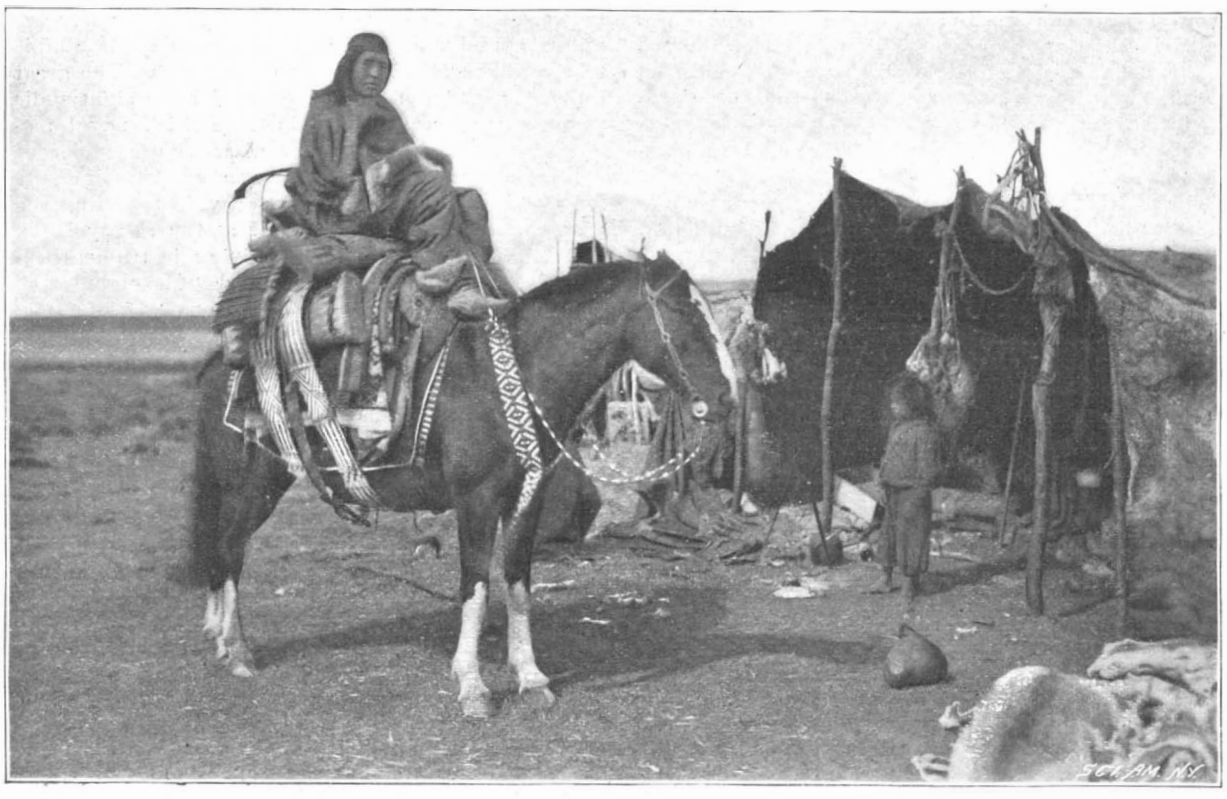
A Sheep Farmer's House in Patagonia.



Balancing Rock Due to Erosion.



Extinct Volcano, Plains of Patagonia.



Indian Woman Ready for the March.

An Old Tehnelche.

**PROF. HATCHER'S EXPLORATIONS IN PATAGONIA UNDER THE AUSPICES OF PRINCETON UNIVERSITY.**— [See page 328.]

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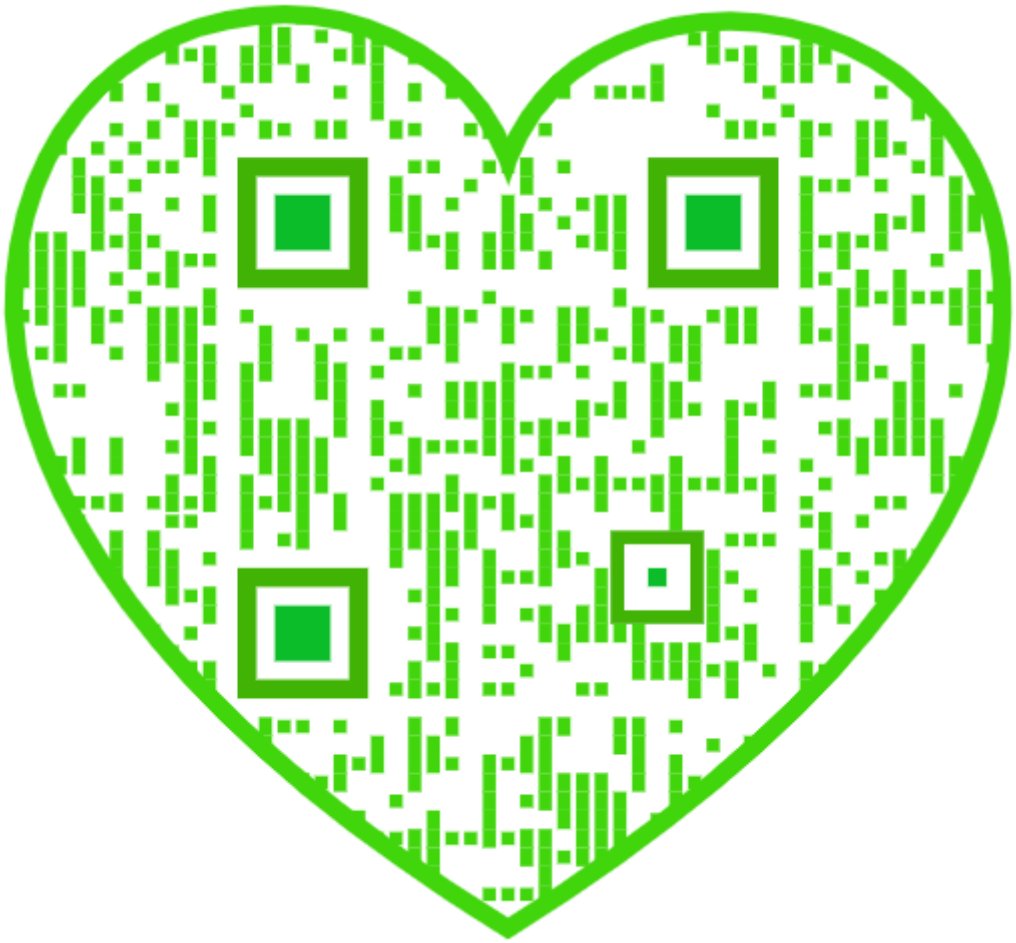

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## THE MAMMOTH POWER STATIONS OF NEW YORK CITY.

In an age when the excessive use of superlative and extravagant terms is one of the glaring faults of journalism, one hesitates before applying such words as "colossal," "mammoth" and their kind in the description of modern works. The rate of progression in the broad field of engineering is so rapid, however, the courage and daring of the engineer are so great, that the world is ever and anon confronted with works which call for superlative terms to give them adequate expression. Of such a kind are the great power houses which are either being planned or built for the three largest railway systems in New York city. When completed they will each exceed any other aggregation of motive power in the world so greatly as to be by comparison positively mammoth in their proportions. The first of these to be completed will be the central station of the Metropolitan Street Railway Company, with a total capacity of 70,000 horse power and following this will be an 80,000 horse power station for the electrical operation of the system of the Manhattan Elevated Railways, and an even larger station, with a reported maximum capacity of 100,000 horse power, for operating the electric roads of the Third Avenue Railway Company.

It is a curious fact that only a few years ago the largest aggregation of horse power was to be found in the engine rooms of the big Atlantic liners. The twin engines of the Cunard liner "Campania," for instance, indicated 33,000 horse power on her trial trip, each engine developing about 16,500 horse power. This has probably been surpassed by this time in the power house of the Niagara Falls Power Company, where the erection of the last of the ten 5,000 horse power turbines must be nearing completion. Apart from the hydraulic installations at Niagara and elsewhere, there is to-day no single power station in the world where the collective horse power of the steam engines equals or even approaches that to be found in the "Campania," "Lucania," "Kaiser Wilhelm," or "St. Paul."

The Metropolitan Street Railway Company's station, however, will exceed the maximum output of the "Lucania's" engine room by over 100 per cent. When completed, it will include eleven cross-compound engines of 6,600 maximum horse power, and the whole series could be completed and in operation early in the coming year should the demands of the system call for such an output by that time. The preliminary design for the power house of the Manhattan Elevated Railways provides for eight huge four-cylinder compound engines, each capable of developing 10,000 indicated horse power. Two of the cylinders will be carried vertically above the crankshaft on the usual A-frames, and the other two will be placed horizontally, all four cylinders working upon a common shaft. The huge size of these engines may be judged from the fact that each one will be capable of developing more power than the total output of any but a few of the largest steam-driven central stations in the country.

## SOIL PARASITES.

Many of our farmers have observed in the past few years that crops which they formerly cultivated with success could no longer be grown. They tilled and fertilized their fields with their usual care, but the plants withered and died from no apparent cause. A careful investigation of the evil by the Department of Agriculture has shown that the soil in many regions of the United States, devoted to the cultivation of special crops, is infected with several most deadly varieties of parasitic fungi. The experiments and researches of the department have been exhaustively described by Dr. Erwin Smith in a paper which he read before the Botanical Section of the American Association for the Advancement of Science, and which we publish in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

Dr. Smith's investigations show that soil fungi have ravaged the fields of the watermelon region, the cotton section, the cabbage district of New York State, and the tomato lands of Florida. To such an extent has the melon fungus infected the soil of our Southern States that watermelon growing has been sometimes rendered impossible, and in certain parts of South Carolina, Virginia, and Mississippi the industry has been almost given up. In one of the finest cotton-producing districts in the world (the "Sea Island" belt, extending from South Carolina to Georgia) many growers have been compelled to abandon their devastated fields. The cabbage growers of New York and the tomato farmers of Florida have suffered similarly.

That the evil is primarily due to soil parasites or fungi is fully proved by Dr. Smith's experiments. Merely by burying the fungus in the earth the characteristic signs of contamination are obtained in the plant. Microscopic examinations show that the parasite completely fills the water-ducts of the stem. The leaves wither; and, if the weather be dry, the plant never recovers. Even if the weather be moist, the plants soon droop under the heat of the sun. A plant may be contaminated at any stage of its development, from the seedling just shooting from the ground, with no leaves except cotyledons, to the full-grown vine with ripening fruit and dense foliage. From external indications alone the disease can not be diagnosed. Only by a microscopic examination of cross-sections of the plant stem is it possible to ascertain the true cause of the wilting of the foliage, for the white, cotton-like stuffing which fills the passages is an unmistakable sign of soil-fungus infection. As the plant dies the fungus comes to the surface, and in fruiting changes its form entirely. In his attempts to cross-inoculate the varieties of fungi Dr. Smith has been unsuccessful. Morphologically the parasites are apparently similar; physiologically they seem altogether different from one another.

The farmer naturally asks: What is the remedy for this soil-infection? Unfortunately no answer can be given. The malady is of such recent discovery, and so little is known of the fungi, that, for the time being, only precautionary measures can be recommended. The usual methods of curing vegetable diseases are utterly ineffective. A field once attacked by a particular parasite can henceforth produce no healthy plants subject to contamination by that parasite. Perhaps, as Dr. Smith suggests, the disease may be due to a disregard of one of Nature's first requirements—the rotation of crops. Year after year, the grower of especial crops will plant his ground with the same vegetables, until at last the soil, besides becoming "sick," accumulates a mass of decaying tissue which constitutes an excellent culture-bed for parasites. The moral is plain enough. The crops grown in soil still untainted should be carefully changed every two or three years. Contamination can be prevented only by burning diseased plants and by exercising the utmost care in separating the infected vines from the hay and other crops stored away during the winter; for so tenaciously do these fungi cling to life that, if not destroyed, they will attack the soil in the following spring with the same deadly effect as in the previous year.

## BIDS FOR THE PROPOSED CRUISERS.

The SCIENTIFIC AMERICAN, as our readers are well aware, has taken a firm stand against the proposal to add a fleet of 15½ to 16½-knot half-protected cruisers to the United States navy. We have felt that the construction of these ships would be so prejudicial to the interests of the navy as to call for a most emphatic protest. It is not necessary to say that in criticising the department's plans and specifications we have been satisfied that they were drawn up with the best possible intentions, and that the objects aimed at in these vessels were considered by the department to more than outweigh their obvious deficiencies.

The position taken by the SCIENTIFIC AMERICAN is that, if the department was sacrificing speed and protection in favor of coal capacity and steaming radius, it has certainly failed to show adequate compensation in the latter particulars. We pointed out some weeks ago that a fine opportunity was presented to the private shipbuilding firms of the country to show what they could do in offering their own alternative designs, and we are glad to know that the bids which have recently been opened for the construction of these cruisers prove that the country possesses private shipbuilding yards which are prepared to build on their own plans and specifications cruisers which, although they are of the same displacement as contemplated in the department's design, will carry more coal and have from 1 to 2½ knots per hour greater speed. We have not been able to obtain the particulars as to the amount of protection contemplated, but we know that in every case the coal capacity has been increased, and we presume that the armored protection is not less than the 2 inches which is specified in the plans of the department. It is also gratifying to note that this increase of efficiency is obtained with practically no increase in cost, the amount of the bids being about the same for the improved designs as for those of the department.

Of the bids which have recently been opened, the one which commends itself most on the score of speed and coal capacity combined is put in by the William R. Trigg Company, of Richmond, Va., on their own plans and specifications. They offer to build one cruiser of 3,283 tons trial displacement, 19 knots speed, and 770 tons bunker capacity, for $1,079,000, the vessel to be completed in twenty-four months: or they will build two vessels of the same type, in the same time, for $1,039,000 each. Compared with the department's design, this vessel, on 83 tons more trial displacement, will have 2½ knots increase of speed, and an increase of 70 tons in the total bunker capacity. The same firm puts in a design for a vessel of the same displacement and of 18 knots speed and 830 tons bunker capacity, of which they will build one for $1,041,000; and two for $993,700 each. They will build a vessel of 18 knots and 785 tons bunker capacity for $1,073,000; or two of the same type for $1,024,700 each. The Fore River Engine Company, of Baintree, Mass., will build a 3,200 ton vessel, with a speed of 18 knots, and a total bunker capacity of 866 tons, for $1,065,000: or they will build two of the same type for $1,020,000 each. They will also build a vessel of the same coal capacity and displacement, but of 18½ knots speed, for $1,100,000; or they will build two for $1,066,800. Townsend & Downey, of New York, offer to build a 3,250 ton vessel of 17½ knots speed, total bunker capacity not stated, for $1,059,500.

Ten firms have put in bids on the department's plans for a 3,200 ton 16½-knot cruiser of 700 tons bunker capacity, the lowest bid being that of Townsend & Downey, New York, who offered to build one boat for $954,500 in twenty-one months, or two boats for $950,000 each in twenty-seven months. The highest bid is that of Moran Bros. Co., Seattle, Wash., who offered to build one boat in thirty months for $1,122,000.

It is evident that unless there are defects in the alternative plans and specifications offered by the builders or the Department has doubts of the ability of the firms that make these bids to carry out the contract, the United States navy is in a fair way to secure vessels which are fairly well up to modern requirements. The William R. Trigg Company, which offers the highest speed, also puts in the lowest bid but one, the lowest being that of Townsend & Downey, of New York, to build two of the 16½-knot cruisers of 700 tons coal capacity for $950,000 each. This bid, however, in respect of value for price, is far inferior to that of the Trigg Company, who offer to build two 18-knot vessels with 830 tons coal capacity for $993,700 each. The Trigg Company, which has lately launched the "Shubrick," has other ships upon the stocks for the United Sates navy, and is unquestionably well able to live up to the full terms of its proposal.

In any case we trust the Department will give the preference to such proposals as guarantee high speed and superior coal capacity. No mere saving of a few thousand dollars can warrant the acceptance of inferior designs. The whole country is fully alive to the merits of the question, and will watch the making of the awards with close and intelligent attention.

## NAVAL TESTS OF MARCONI TELEGRAPHY.

In the current issue of the SUPPLEMENT will be found illustrations of the tests of the Marconi system of telegraphy recently carried out on the warships "New York" and "Massachusetts." The illustrations are reproduced from photographs taken during the course of the trials. Messages were sent and received between the two ships up to a distance of forty-five miles, beyond which the apparatus proved to be unable to record the messages with distinctness. The great difference between these results and the eighty-mile transmission accomplished in the British naval maneuvers is explained by Marconi on the ground that he only brought to this country apparatus designed for the limited distances necessary in reporting the yacht races to a ship stationed at the Sandy Hook lightship. The sending and receiving instruments installed on the "New York" and "Massachusetts" were the same as those used on "La Grande Duchesse" and the "Mackay-Bennett" cable ship, and their operation is stated to have been thoroughly successful up to the limit named. Mr. Marconi informs us that it was only two or three years ago that Mr. Preece, who was so active in introducing the system in England, named ten miles as the probable limit for wireless transmission, and the fact that in so short a time messages have been sent over eighty miles of sea and one hundred and ten miles of land and water, augurs well for the future development of the system.

## OPENING OF THE NEW YORK ZOOLOGICAL PARK.

With fitting ceremonies the new Zoological Park in Bronx Park was formally opened to the public on Nov. 8. Special trains took the guests to the Fordham Station, where conveyances were waiting to take them to the main entrance, where Director W. T. Hornady received the Hon. Levi P. Morton, President of the Society, the Controller, Mr Coler, and Park Commissioner Moebus. After brief exercises the guests were allowed to wander at will through the beautiful grounds.

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Twenty-five buildings have been completed, and already 850 specimens have been assigned to their proper buildings or grounds.

### REPORT OF THE BUREAU OF STEAM ENGINEERING.

Limitations of space prevent our making anything more than a brief reference to the annual report of Admiral Melville, Chief of the Bureau of Steam Engineering, and our readers must turn to the current issue of the SUPPLEMENT for the digest of this publication. The most interesting parts of Admiral Melville's report are those in which he dwells upon the questions of the personnel, and the use of electrically driven auxiliaries on our warships. He regrets his "inability to see indications of the desired results, thus far, of the personnel bill," which according to his belief "contemplated most earnestly vast additions to the number of officers who would give earnest attention to engineering matters, and in no way implied a desire to augment the forces available for merely former line or deck duty." He still hopes that "the comprehensive union of the line and engineering vocations will be the result of the personnel change. . . . The only possible scheme is to insist upon the present line officer adapting himself as soon as possible to the new conditions, and increasing, where lacking, his knowledge of mechanical engineering."

In our issue of October 28, we drew attention to the fact that there was a danger of the tendency to replace the steam auxiliary by the electric motor being carried too far on our warships. Admiral Melville devotes considerable space to this question, and argues to the same effect. He shows that if all the auxiliaries on the "Alabama" were operated electrically there would be an increase of from 150 to 250 tons in the total weight of machinery. The increased space required in the generating rooms would accommodate 900 tons of coal or 3,600 horse power could be added to the propelling engines. Evidently the electric auxiliary is extravagant in weight.

### MASSES SMALLER THAN ATOMS.

At the recent meeting of the British Association Prof. J. J. Thomson, F.R.S., gave an interesting account of recent researches on the existence of masses smaller than atoms (Phar. Jour.) He showed that several lines of investigation led to a determination of the ratio of the mass of an atom to the electric charge conveyed by it—namely, ordinary electrolysis; experiments on the velocity of charged particles, and experiments on the velocity of cathode discharges. These experiments indicated that the charge carried by an atom in cathode discharges and similar phenomena is apparently 1,000 times greater than in ordinary electrolysis, consequently either the atoms become dissociated and only a portion of their mass carries the negative charges of cathode rays, or else the atom can receive a greater charge than is assigned to it in explaining electrolytic phenomena. To discriminate between these two assumptions a method was employed to determine separately the charge carried by a known number of atoms in a case for which the charge per unit mass had the greater value. The method used was described as follows:

A flat metal plate, negatively electrified, is brought near to a very large perforated metal plate through which ultra-violet radiation can pass, the whole apparatus being inclosed in gas at a pressure of about $\frac{1}{100}$ millimeter of mercury. The radiation causes a discharge of electrified particles, from the negative plate, which move in parallel straight lines to the perforated plate which receives their charge. If now a magnetic field be set up between the plates, its direction being parallel to the plane of the plates, the paths of the particles become curved; in fact, cycloids, and the particles may not reach the perforated plate if the latter is far enough away from the negative plate. There will, therefore, be a diminution in the rate of discharge, which is the phenomenon actually observed; its amount corresponds with theory if the large value of the charge per unit mass is assumed. The charge conveyed per second is the product of three quantities—the number of "atoms," the charge on each, and the average velocity of the atoms. The charge conveyed per second may be observed and the average velocity determined by a method devised by Prof. Rutherford. If the number of atoms be determined, the charge on each may be immediately found. These electrified atoms behave as nuclei on which water drops will condense when a cloud forms in the air; it is only necessary, therefore, to know the total amount of vapor condensed and the size of each drop in order to determine the number of drops, which is the same as the number of atoms. The amount of vapor condensed is obtained by suddenly and definitely expanding air of known humidity from a given higher to a given lower pressure, and the size of the nuclei is obtained from the rate of their fall, since, like raindrops, they can only attain a definite velocity.

To ascertain if the mass is collected at a point or diffused through space, the mass is allowed to impinge against a surface which is transparent to the energy carried—such as Roentgen radiation or cathode rays—but which does not allow material of infinite size to pass through it. In all the experiments the atoms possessed, negative charges; when positive charges are carried, the results of experiments agree with those on electrolysis. The amount of charge carried by an atom depends on the gas and the nature of the electrodes. From this it would appear that electrification seems to consist in the removal from an atom of a small corpuscle, the latter consisting of a very small portion of the mass with a negative charge, while the remainder of the atom possesses a positive charge.

### INTERESTING EXPERIMENTS WITH PHOTOGRAPHIC PLATES.

Mr. W. J. Russell has presented to the Royal Society of London a series of researches which he has recently made as to the action of certain substances upon the photographic plate. It has been found that a polished metallic surface, such as magnesium, zinc, etc., or in other cases a layer of oil or similar substance, is capable of producing at a distance an effect upon the sensitive plate similar to that caused by the action of light. A certain number of hypotheses have been advanced to account for this action, among others that of phosphorescence or the emission of actinic rays by the substances in question. Mr. Russell, after having made a number of interesting experiments, concludes that this action is due to the formation of hydroxyl, and finds that by its use all the effects produced by these different substances may be equally observed. In order to observe this action upon the photographic plate, the experiment may be made very easily in the following manner. Into a small glass basin or watch-glass are placed a few drops of the liquid to be examined, and the glass is covered with the photographic plate. In the case of pure water, no action is observed at the end of twenty hours, but upon the addition of a very small quantity of hydroxyl, the plate is immediately affected, as will be shown upon developing it in the ordinary manner. This action is extremely delicate, as 1 part of hydroxyl in 1,000,000 parts of water is sufficient to produce a slight effect upon the plate at the end of eighteen hours. If a piece of blotting paper is wet with a solution of 1: 500,000, dried and placed for two hours in contact with the photographic plate, a distinct image appears upon development.

The experiments carried out by Mr. Russell seem to indicate the conclusion that the action of different metals, etc., upon the plate is due to the formation of a minute quantity of hydroxyl, which is sufficient to cause the action. The metals which are found to be the most active are, in their order, magnesium, cadmium, zinc, nickel, aluminum, etc. It may be supposed that these metals are capable of decomposing water or water vapor and cause, in the presence of oxygen, the formation of hydroxyl. Their order of activity is exactly that in which this formation would take place, as can be proved by their action upon the test paper of Dr. Wurster. These papers, when moistened and placed in contact with the first metal of the series, take a dark blue color, which is absent in the case of the non-active metals. According to this supposition, the action upon the plate should be more strongly marked in the presence of water vapor. This may be verified by the following experiment. A glass tube containing zinc turnings is traversed by a current of air which passes into a dark box containing the plate. With ordinary air the action is feeble, but with air containing a large proportion of water vapor it is strongly marked. Without the presence of the metal no action whatever is observed. In the case of organic bodies which produce the same effect upon the plate, these are found to belong for the most part to the class of terpenes, and it is well known that these substances in oxidizing give rise to the formation of hydroxyl. Another interesting point observed by Mr. Russell is that the action takes place through certain membranes, such as gelatin, celluloid, etc., but that glass or mica cuts off the action. In considering this effect, the supposition that it is caused by the diffusion of the hydroxyl through these substances is impossible; there is probably a kind of solution or combination with the membrane or one of its constituents, which permits the hydroxyl to find its way to the outer surface. The following experiment throws some light upon this action. A solution of hydroxyl, 2 per cent, is placed in a glass basin; this is covered with a sheet of gelatin ¼ millimeter thick. The sensitive plate is placed over the gelatin and left for twenty minutes; at the end of this time no action is observed. A fresh plate is then substituted and again left for the same time, when a feeble impression is obtained. A third and a fourth plate show an increase of action, but in the case of all subsequent plates the action remains stationary. It thus appears that the quantity of hydroxyl emitted by the upper surface of the gelatin increases during one hour and twenty minutes, but after that time it remains uniform. A similar effect may be obtained by using a plate of zinc or a layer of some of the essented oils. It may then be asked by what body is the hydroxyl transmitted. It is probably by means of the water contained in the membrane. This may be observed in the case of bristol board, etc. If one interposes a sheet of dry bristol board between the active substance and the plate, no action is observed, but upon moistening the bristol, a marked action takes place. Alcohol produces similar results. Thus it may be seen that the water or alcohol serves as a vehicle for the hydroxyl in some of the membranes. In the case of celluloid, the action of water cannot be assumed. In this case it seems that the role is filled by the camphor contained in the celluloid. Although camphor is quite inactive in itself, if it is placed for some time in a solution of hydroxyl or essential oil, it will cause an action upon the plate; if one interposes a thin piece of camphor between the solution of hydroxyl on the plate for sixty-six hours, an impression is obtained. It will be seen that the camphor, which is one of the principal constituents of celluloid, may thus absorb the hydroxyl and permit it to penetrate the membrane. In the case of gutta percha or caoutchouc membranes an analogous action is supposed, for although the chemical constitution of these bodies is not yet clear, it is known that they contain bodies nearly allied to camphor.

By means of these and similar experiments, Mr. Russell seems to have proved conclusively that this action of metals, etc., upon the photographic plate is due to the presence of hydroxyl. He proposes, in later researches, to elucidate the manner in which the sensitive plate is acted upon by the hydroxyl.

### COLORING BROMIDE PRINTS.

A number of processes have already been given for the coloring of bromide prints. M. Henry has obtained very good results with the use of oil or water colors as well as for pastel in the following manner:

For oil colors, a hot solution of three per cent of good white gelatine is spread upon the surface of the print by means of a wide and fine sable brush. After drying, the layer thus formed will take oil colors readily, and one may proceed to color the print as desired. For water colors, the best results are obtained by the use of a solution of 120 grammes shellac in 240 c. c. alcohol. When completely dissolved, the solution is allowed to stand for twenty-four hours, and is diluted by taking 120 c. c. of the former and 120 c. c. alcohol. This is to be filtered before using. The solution is applied to the surface of the bromide print by means of an atomizer until it appears to be slightly wet. When the print is well dried, which takes from ten to fifteen minutes, water colors may be applied as desired. If in certain parts the print does not take the color sufficiently, the process of applying the solution is repeated in these places. The fixative varnish used for charcoal drawings, etc., may be used instead of the solution of shellac. The use of pastel is especially in favor for retouching or coloring bromide prints, but it is necessary that the paper should have sufficient grain in order that the pastel may be readily applied. M. Henry has found that this grain may be obtained by the use of powdered pumice stone in the following manner: A tuft of cotton is thoroughly impregnated with the powder, and, after having applied to the surface of the print a layer of the shellac solution above mentioned, the powder is applied by tapping lightly with the wad of cotton. The print should thus be covered with the powder before the solution is dry; in this way the powder attaches itself, and is fixed during the drying of the solution, leaving below a clear image. If necessary, the operation may be repeated until the desired grain is produced.

### PRODUCTION OF HYDROGEN WITH THE AID OF MAGNESIUM.

M. Lemoine, in a communication recently presented to the Académie des Sciences, has observed the introduction of magnesium into solutions of its salts, such as chlorides, sulphates, etc., gives rise to an active disengagement of hydrogen. This action is strongly marked when powdered magnesium is used with concentrated solutions of these salts. It is well known that magnesium has the property of decomposing water, even at a low temperature, but this action takes place very slowly. The presence of its salts in solution accelerates the disengagement of hydrogen in a marked degree, the gas being given off rapidly with the formation principally of hydrated oxide. The action ceases after a time, and no more gas is given off; this, however, is simply due to the fact that a layer of the hydrated oxide is formed upon the metal, which acts as a protecting covering. If the metal is taken out and cleaned, and the solution filtered, the action goes on as before. M. Lemoine considers that this action has for its point of departure a partial decomposition, to a slight degree, of the saline solution into free magnesia and free acid, which causes the metal introduced to be attacked. In the case of a solution of magnesium chloride, he supposes that an oxychloride is at first formed, which remains in solution, but is soon decomposed with a precipitate of magnesia upon the metal. The magnesium chloride thus formed acts in its turn as before, and thus the action is continuous. It has been found that zinc and cobalt used with concentrated solutions of their chlorides give negative results.

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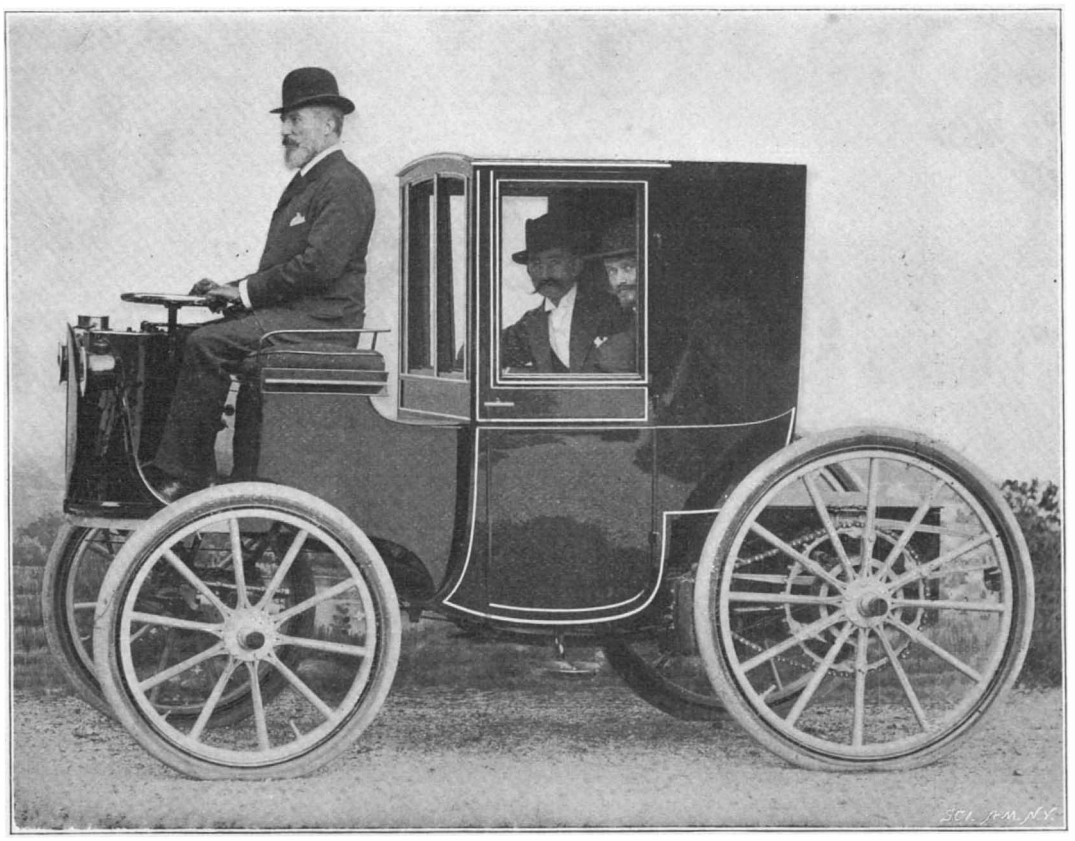
## SOME FRENCH TYPES OF AUTOMOBILES.

BY C. DE KUBICKI.

Among the most important of the systems of electric vehicles now constructed in France may be mentioned that of the Jeantaud Company. M. Jeantaud is one of the pioneers in automobile work, having taken up the question several years ago, when the subject was new and first attracted attention in France. Being at the head of a large carriage establishment, he was well equipped for entering the new field, and at the present time the automobiles made by this company are among the best known in Paris. M. Jeantaud was one of the founders of the Automobile Club of France and is one of the leading members of the Civil Engineers' Society.

The figures show two of the leading types of vehicles made by this firm. Our first illustration shows a two or three-seated cab for use in city service, with M. Jeantaud acting as driver. The two-seated carriage shown in our other engraving is conducted by the Count of Chasseloup-Laubat, one of the leading spirits in automobile affairs and an energetic promoter of the various exhibitions and tests which have been made in Paris under the direction of the Automobile Club.



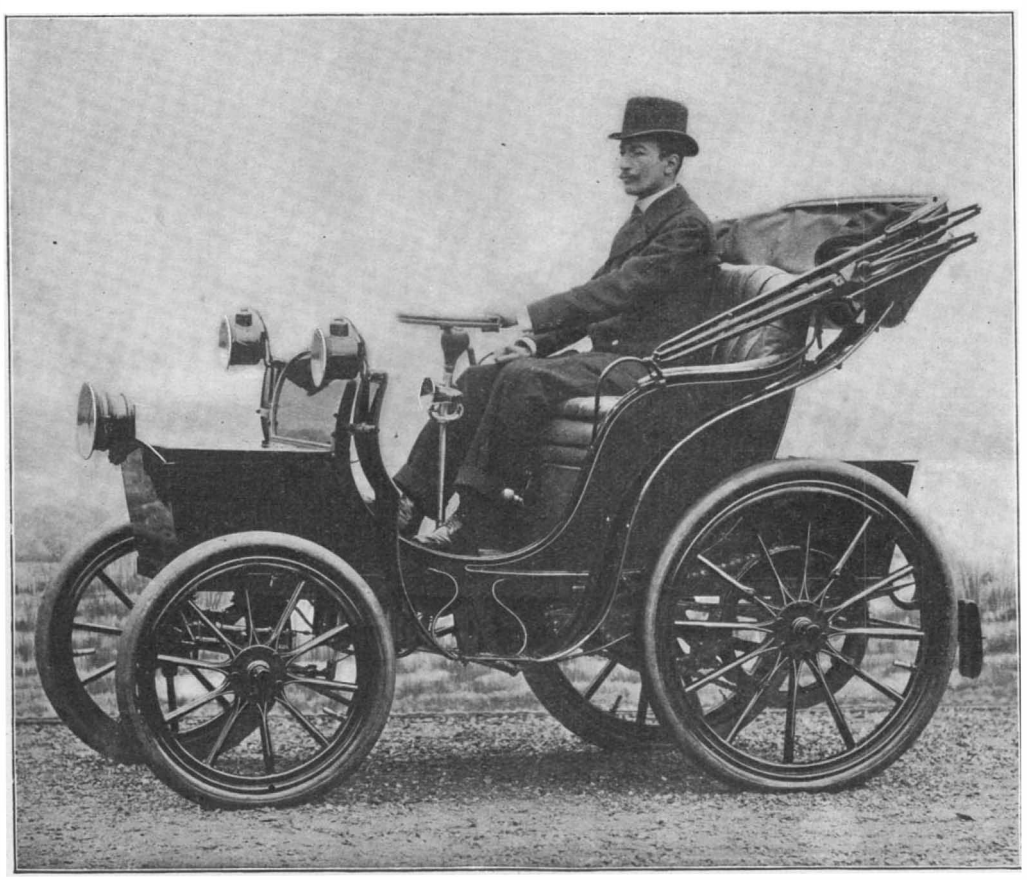
JEANTAUD ELECTRIC CAB, WITH M. JEANTAUD ON THE BOX.

The type of motor adopted by M. Jeantaud for all of his vehicles is that in which the exterior of the motor is arranged to entirely inclose the working parts, somewhat similar to the motors used on electric railways. The speed of the motor is reduced by a pinion and large gear wheel, which, with the differential gearing, are completely inclosed in the envelope of the motor, thus forming a compact whole. In this way the working parts are protected from dust and moisture. The motor is fixed in a convenient place upon the framework of the vehicle between the front and rear axles. At each end of the casing projects a shaft of the differential, carrying a small chain-wheel, over which the chain passes to a similar large wheel on the rear axle. M. Jeantaud prefers the method of driving the rear wheels of the vehicle by chain-wheels in this way, but has also experimented with different methods of transmission. In one of these the rear wheels are driven each by a separate motor. A large gear wheel is fixed to the main axle, on the inner side of the driving wheel, and engages directly with the pinion of the motor. This disposition has the advantage of doing away with the use of differential gearing and makes the system less complicated, each wheel with its motor becoming an independent unit. A system similar to this is now used with success by the Krieger Company. The motors, however, drive the front instead of the rear wheels. Another method, used by M. Jeantaud has been that in which the motor is mounted like a motor for electric traction, that is to say, suspended from the axle driving it by means of a single reduction gearing, the whole being inclosed in a tight case.

In all these different arrange ments, the rear wheels are driven by the motor, and the front wheels used to guide the vehicle. Another system has been tried, by which the front wheels are driven. A single motor is fixed to the frame near the center of the vehicle which operates the differential by means of single reduction gearing. The differential drives the two front wheels by a system of bevel gearing which permits the vehicle to be steered in any direction without interfering with the working of the driving mechanism.

The motors used in these different arrangements are of the Postel-Vinay type, and weigh from 60 to 150 kilogrammes, according to the size of the vehicle. The speed varies from 1,200 to 2,000 revolutions per minute. The same type of controller is used in all these vehicles; it is a vertical drum carrying the different contacts and operated by a horizontal handle, as will be seen in the figure; it is arranged to give different speeds of 4, 8, 12, and 16 kilometers per hour, 12 being the normal speed. A backward motion of 4 kilometers per hour is also provided for. In order to avoid abrupt changes in passing from one speed to another, M. Jeantaud uses a pedal which, acting upon a resistance in the circuit of the motor, modifies the current before the change is made by the controlier. This arrangement has proved very satisfactory in practice, and insures easy running; however, the introduction of resistances is always accompanied by a corresponding waste of energy.

The different French constructors are about equally divided as to the question of using resistances in connection with the controller; some prefer to use only the different combinations of accumulators and windings of the motor. The system of M. Jeantaud has the advantage of obtaining a variation of speed from zero up to the maximum without abrupt changes or shocks. By means of the pedal spoken of, the current may also be cut off, and the electric brake put on with increasing effect up to the maximum, in which case the motor terminals are connected directly to the brake. The electric brakes on these vehicles, as well as on those of most of the French makes, work very satisfactorily, as was shown in this year's tests of electric vehicles; they were made to run down a steep grade at full speed, and the brakes were applied at a given signal. Most of them were able to come to a full stop within a distance of 8 meters.



ELECTRIC PHAETON DRIVEN BY COUNT DE CHASSELOUP-LAUBAT.

In the annual competitive tests just mentioned, which were held under the direction of the Automobile Club, M. Jeantaud entered a number of electric cabs and four-seated carriages, all of which made a good showing, and covered the distance of 60 kilometers laid out over the streets of the city and suburbs in less than four hours, making an average time of 15 kilometers per hour. The maximum consumption of energy has been about 10 kilowatt hours. The tests were made during ten days, and the total distance covered was 6,000 kilometers.

In his presentation of the subject of electric vehicles before the Society of Civil Engineers of France, M. Jeantaud describes his system as well as those of his principal competitors which are in general use. He is of the opinion that the problem of city service will be solved by electric cabs. The competitive tests held in Paris this year seem to favor this idea, and with the influence of the Automobile Club united to that of the prominent manufacturers, there is no doubt that this subject will assume a continually increasing importance.

### Some Electrical Terms Explained.

A consulting electrical engineer, who was asked to put one of the less common electrical terms in plain language, The Boston Transcript tells us, said: "I am frequently resorted to for just such explanations, and nothing surprises me more than the haziness which still exists in the minds of even intelligent folks in regard to the simplest electrical terms. To most people the electrical units are still mere Greek, and comparatively few go to the trouble to take hold of the more common of them, such as 'volt,' 'ampere,' 'resistance,' 'electro-motive force,' etc., and fix their meaning, once for all, in the mind. A man who knows me only by reputation wrote to me the other day that he had done this with much satisfaction to himself, as he has now a far more intelligent idea of electrical doings than he had before. But still, he said, from time to time some electrical words creep into the daily press which conveyed nothing to him. He mentioned as one of them the term 'watt hour.' Now, this is quite simple. The watt is the unit of electric power. It means the power developed when 44·25 foot pounds of work are done per minute, or 0·7375 foot pound per second. A foot pound is the amount of work required to raise one pound vertically through a distance of one foot. When this is figured down so as to be defined in 'horse power,' which is understood by everyone, it can offer no difficulty, and if anyone to whom the word watt is puzzling will remember that a watt is the $\frac{1}{746}$ of a horse power, he will have no more uncertainty about it. Having got so far, it is an easy graduation to the 'watt hour,' which is the term employed to indicate the expenditure of an electrical power of one watt for an hour. In other words, the energy represented by a watt hour is equal to that expended in raising a pound to a height of 2,654 feet. An even easier way of fixing it is to remember that two watt hours correspond almost exactly to raising a pound to a height of one mile. The understanding of such terms opens out some very curious facts to the uninitiated. For instance, a certain dry battery, weighing 6·38 pounds, was known to yield 100 watt hours. If this force were applied in raising the battery itself, it would lift it to a height of over ten miles. Again, in one hour the energy translated in an ordinary 16 candle power lamp weighing about an ounce would raise that lamp to a height of four hundred miles at a velocity of nearly seven miles per minute. Yes, it pays a man to expend a little pains on mastering the ordinary electrical terms."

In a recent patent for a trolley wire guard porcelain insulator connects the trolley wire with the guard wire, and at intervals the latter is electrically connected with the railway return circuit.

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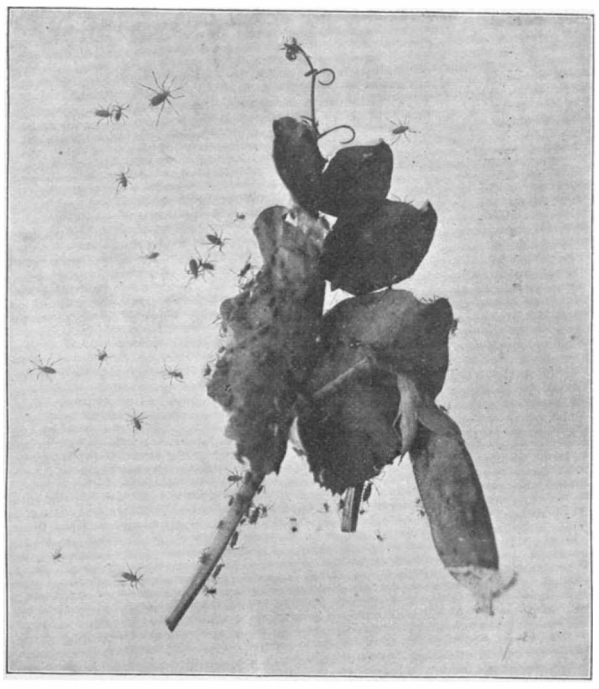
## THE PEA LOUSE, A NEW AND IMPORTANT ECONOMIC SPECIES OF THE GENUS NECTAROPHORA.*

The following account is, perhaps, one of the most unique recorded in entomological literature.

The injury by the new pea louse in many places has been complete, and has not been confined to the pea-growing areas of Maryland. I have had it reported from Delaware, New Jersey, New York (Long Island), Pennsylvania, Virginia, North Carolina, Connecticut, and recently from Canada. So far as I can ascertain, this is the first season it has been abundant enough to



THE PEA LOUSE (*Nectarophora destructor*) WHICH DESTROYED $3,000,000 WORTH OF PEAS IN MARYLAND THIS YEAR.

attract attention from the economic standpoint. Talking with some of our largest growers, I find that the louse was present in some sections last season, although it was not reported. Some of the laborers who handled the peas in the field complained that the lice got upon them, and some (colored) even refused to pitch peas from certain fields. Last fall the lice were observed on late peas in sections of New Jersey.

The lowest estimate of the loss in Maryland this season, given by the most conservative authority, is $3,000,000. That this enormous loss should have been attributed to a single species, especially one new to science, hardly seems possible. The loss in other States has been proportionately as great as in Maryland. Never in the history of economic entomology has a similar case been recorded.

DESCRIPTION OF THE INSECT.—The creature to which a large proportion of this loss is attributed is one of the plant lice, a group of insects called aphids, and belonging to the hemipterous family Aphidæ. Strange as it may seem, this insect is one new to science, and by some change in conditions has become conspicuously abundant this season over wide areas upon the cultivated pea for the first time. Why this should be so is one of Nature's mysteries, and affords material for future investigation, reflection, and thought. The insect under consideration, while it had been seen before by entomologists and others, was not compared with other closely related species to see if it had been described. It properly belongs to the old genus Siphonophora, but as this name had been preoccupied for the Myriapoda before Koch made use of it in his work, and is also used to denote an order of oceanic Hydrozoa, therefore, in accordance with zoological practice, we have been obliged to substitute another generic name. Mr. O. W. Oestlund, in his monograph on the Aphidæ of Minnesota, suggests the name Nectarophora in place of Siphonophora. We accept this name, and henceforth the pea louse will be known in literature as a Nectarophora; specifically I propose to call it *destructor*. Its full name, therefore, will be *Nectarophora destructor*.

The insect responsible for this injury is a small, green louse, resembling the color of the vine, and when full grown is about one-eighth of an inch long. It has many interesting things about its life history and habits. In the first place, the young are born alive. If a person should watch one of the larger individuals for a short time, he would see the young protruding from the body of the mother. I have, upon several occasions, shown this wonderful operation to farmers and others this season. Upon the same leaf one will find the lice, from the newly born to the adult. As a rule, the majority of the lice are wingless; but as a plant becomes overcrowded or fails to furnish the necessary food supply, wings appear and they take flight to more favorable feeding grounds. Thus the species is spread rapidly from field to field. Upon one occasion this season, when I was making observations in a 42-acre field which had been completely destroyed, the insects were taking flight and leaving in such great numbers it was very disagreeable to ride or walk through the field. It obtains its food by sucking the juices from the leaf and stem. They cluster upon the plants in great numbers, getting between and underneath the leaves. They insert their lance-like beaks into the tissues of the plant and draw out the sap. The lice exude a honey-dew, and this is smeared over the plants. The lice cast their skins several times during growth, and these cast skins adhere to the leaves in the honey-dew, giving badly infested vines the appearance of having been dusted with something white. The vines wilt and die from the attacks of the lice. We know of one instance where 480 acres out of 600 were a total loss; we have records of another where 400 out of 510 acres of peas were lost. We have many records of acres, from the garden patch to a 100-acre field, that have been destroyed by this pest this season.

In view of the fact that we have, as yet, found no satisfactory remedy for the destruction and control of this species, we have spent much time observing the natural enemies.

The most important natural reducing agents have been the Syrphus fly larvæ. I have observed three species, one of which, *Allogropta obliqua*, has been abundant. In one instance twenty-five bushels of larvæ of this species were screened out by a prominent packer, the last three days he worked. Such a statement seems incredible; but actual observation proved that nature was doing her part thoroughly. At this time hardly a louse could be found, where only a week or ten days before they were working by countless millions.

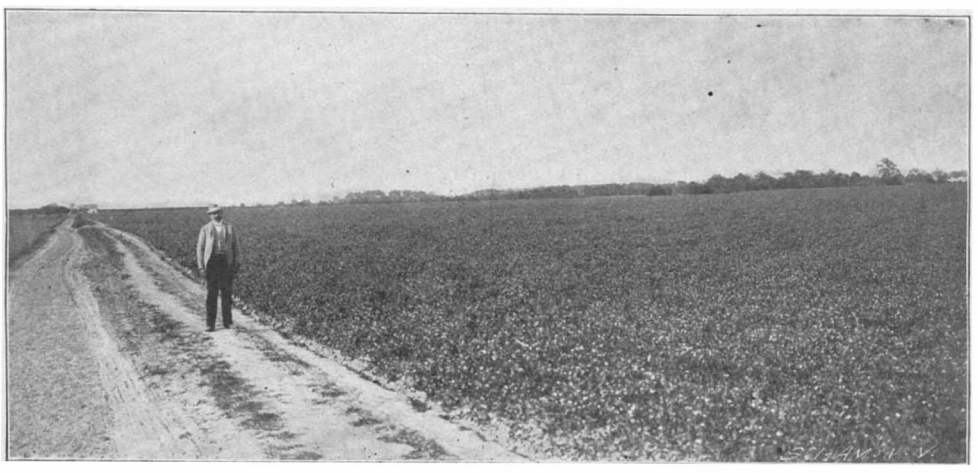
The American Syrphus, *Syrphus americanus*, usually has been associated with the preceding species. The larva is larger than that of *Allogropta obliqua*, brownish in color, somewhat mottled, and longer. It also pupates upon the plant, or even at or below the surface of the ground. The adult is much larger and can be distinguished, even during flight, by its bee-like hum. The remaining species, *Sphærophoria cylindrica*, was not common, but found in two localities associated with the others, and is much smaller than either of them. Of the native lady beetles, four species were observed feeding upon the lice. *Coccinella notata* was most abundant in Frederick and Carroll Counties, in which both adults and larvæ everywhere swarmed in the fields. June 30 I found pupæ of this species attached to weeds, leaves, grass, and corn—in fact, almost everything where larvæ could secure a hold. Sometimes three or four were found upon a single leaf. The lice were on the decrease, and it was clearly seen that the lady beetles, etc., would nearly destroy those remaining. *Megilla maculata* was found in nearly every field examined, and an occasional specimen of *Coccinella sanguinea*. *Hippodamia convergens* was also quite abundant. The larvæ and eggs of the laced-winged fly, *Chrysopa oculata*, were found throughout the infested districts of the State, and it has been an important factor in the reduction of the lice. The soldier beetle, *Podabrus rugolusus*, was also observed by me feeding upon the lice in my garden near the college.

This completes the list of predaceous insects observed and bred. I was surprised, however, in not finding any hymenopterous parasites in the lice. The only parasite bred was *Bassus lœtorius*, which is considered a parasite on the Syrphus fly larva. On June 18 I noticed a number of dead lice. The disease continued until about the 25th of June and finally disappeared. Sometimes ten to twelve dead lice were found in all stages of development upon a single leaf. The same disease has since been reported to me in pea fields in New Jersey. A few lice were found on peas in my garden through the greater part of June and July, and in September were reported as still doing injury to sweet peas in Canada.

As to the future, candidly, I am of the opinion that it will be many a day before we shall see a repetition of such devastation of the pea crop by *Nectarophora destructor*. Nature has done her work well, and there is nothing left for the economic entomologist to do except to acknowledge his inability to cope with such mysterious visitants and plod along as best he can. Mother Nature seems to be calling a halt; but man, in his eagerness to gain a livelihood, is going ahead blindly, apparently not heeding her challenges that he is going too fast.

To bring more vividly before you the ravages of this pest, I have here photographs of a 42-acre field, also of a 100-acre field (shown in the illustration); and these are the places where the pea vines were plowed down at my suggestion. From the photograph you will see the normal peas in the middle, where they were not attacked by the insects, and those at the side showing the dwarfed, diminished peas usually found on the vines at the time the vines were found stunted and shriveled. In another view you will find a few of the lice themselves, literally covering the leaf.

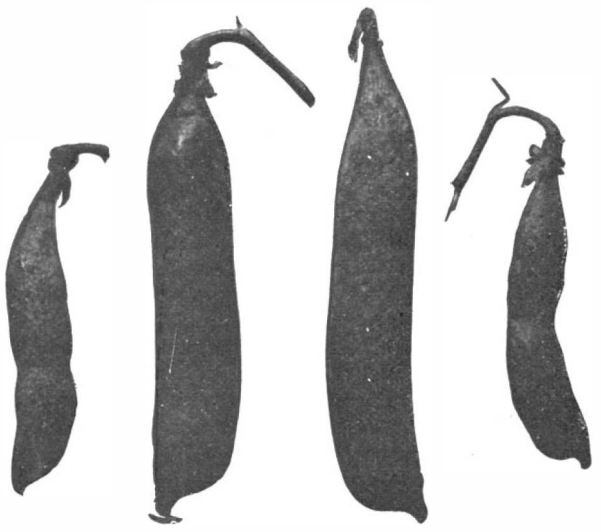
* A paper by Prof. W. G. Johnson, of the Maryland Agricultural College, College Park, Md., read August 19, 1899, at the Ohio State University, Columbus, O., before the Association of Economic Entomologists. Revised by the author especially for the SCIENTIFIC AMERICAN.



FIELD OF 100 ACRES, SHOWING CROP OF PEAS DESTROYED BY THE PEA LOUSE.

### Wood Pulp for Poultices and Surgical Dressings.

Mr. Frederick T. Gordon, a hospital steward at the League Island navy yard, has been for some time conducting experiments on the use of wood pulp in surgery and he gives the results of his experiments in a recent number of The Medical Record. Wood pulp is obtained in its crude form from the manufacturers and comes in sheets of any size and thickness. It is cheap, easily obtained and possesses valuable properties. When macerated in water, it wells up and absorbs from four to five times its weight of liquid, retaining it for a long time. As the pulp becomes soft a poultice of any desired consistency can be made by varying the quantity of the water. By using hot water the resulting poultice will retain its heat and moisture much longer than a similar poultice made of bread or flaxseed. Of course, antiseptic drugs soluble in water



PHOTOGRAPH SHOWING PEA POD IN NORMAL CONDITION AND DWARFED BY PEA LOUSE.

may be dissolved in the water in which the pulp is to be soaked, as the pulp itself is unaffected by most drugs. When dry, the pulp will absorb both oils and fats. This is particularly valuable, as it can be used as an emollient and antiseptic substitute for salves, etc., on lint as a surgical dressing. Wood pulp can be molded when moist, so that it can be used as a splint, owing to the fact that it dries very hard. When kept slightly wet with an antiseptic solution, the pulp remains soft and can be used as an absorbent dressing. Crude wood pulp can be sterilized by heating in an ordinary sterilizer. If the heat is increased so that the surface is charged, it will act as a deodorizing dressing. Poultices of wood pulp are far superior to flaxseed, and being perfectly stable do not deteriorate in any climate, and owing to its small compass a considerable supply can be carried. Should it become wet, it can be dried in an ordinary stove. It is an ideal material for the country practitioner, being always the same, insuring uniform results. A sheet four feet square costs only about 15 or 20 cents.

THE Wagner-Pullman Palace Car combination is an important event in the railway world. The Pullman Company was organized in 1867 to operate a service of sleeping and parlor cars. The company owns and controls about 500 cars, which are operated over 121,662 miles of railway in the United States, Canada, Mexico and in some places in Europe.

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### Science Notes.

The Appeal Court of England holds that a reporter has no copyright of the report of speeches giving not only ideas, but words by which the ideas are expressed. A lower court decided that The London Times had copyright in reports of speeches. The Times will take the case to the House of Lords.

There will be a model American post office at the Paris Exposition. Arrangements have been made with the French postal authorities whereby mails for Americans in Paris will be sent directly to this office instead of going through the regular channels. The post office will be fitted up with all of the modern postal appliances.

Serious apprehensions are felt that the drought now prevalent throughout the United States will prove a serious injury to the paper trade. There is great difficulty in filling orders. In Maine particularly the water supply has not run as low as at the present for nearly forty years. Mills which run by water power are seriously crippled in most cases.

A prize of $100 has been offered by Dr. Louis L. Seaman for the best thesis on the following subject: "The Ideal Ration for an Army in the Tropics." The competition is open to all commissioned medical officers of the United States army and navy. It is offered through the Military Service Institution of the United States, and the competition will close on March 1, 1900.

It is said that silkworms are very sensitive to the action of light of different colors, and according to experiments recently described by Flammarion, before the French Academy of Science, silkworms were kept in boxes covered with glass of different shades. The silkworms all received the same food, but they gave different results as to the quantity of silk and eggs, and also in the proportionality of the sexes.

The Royal Institution of Great Britain has just published an attractive pamphlet on the Spottiswoode collection of physical apparatus, which was presented to the Royal Institution by W. Hugh Spottiswoode, in 1899. The late William Spottiswoode, who died in 1883, will be remembered for his remarkable experiments in electro-magnetism, by his great induction coil, by his work in light and for his frictional electrical machines.

An extraordinary operation was performed a few days ago at Bellevue Hospital, New York city. A messenger boy lost his nose and his right eye in a trolley car accident last June. In order to save his life the doctors allowed his wounds to heal; finally it was decided to perform an operation which should give the boy some relief from the disfigurement of his face. A gutta percha base was shaped, and over this the skin was drawn together with fine silk sutures and the wound was allowed to heal. The operation was an entire success.

Interesting experiments with the Pollak-Virág system of fast-speed telegraphy were made on several occasions recently between Budapest and Vienna; a speed of 1,300 to 1,500 words per minute was obtained. Transmission is effected by a perforated strip of paper as in the case of the Wheatstone automatic telegraph, and a telephone fitted with two small mirrors serves as the receiver, the diaphragm of the telephone being set into oscillation corresponding to the current impulses generated by the transmitter. These oscillations are made visible photographically. This extremely interesting system, illustrated by records, is given in the current number of the SUPPLEMENT.

The ordinary belfry bell, in order that its full power may be felt, is necessarily an imposing mass of metal, but an Englishman has succeeded in producing bells which are absolutely cylindrical and which do away with many of the disadvantages of the ordinary bells. Whatever be the note that is to be furnished, the tube that gives it is of constant diameter and thickness for the various tones, and differ only in length. The result is a great saving in metal, and the possibility of obtaining notes with mathematical precision. Such an advantage is not a slight one, since the harmonizing of ordinary bells necessitates a special corps of tuners. The tube bells are illustrated and described in the current number of the SUPPLEMENT.

A number of experiments have been carried out by Boland on the formation of pigment by the Bacillus pyocyanens (Centr. f. Bak., xxv., p. 897). He finds that this organism forms only two pigments, a fluorescent one, apparently identical with that formed by many other bacteria, and the blue pigment pyocyanin, which by oxidation becomes converted into a reddish-brown pigment, pyoxanthose (pyoxanthin). A blue chloroform solution of pyocyanin becomes quickly changed to a green by sunlight. A blue watery solution of pyocyanin is likewise changed by chlorine. The green chlorophyl solution treated with dilute (1:3) sulphuric acid becomes a deep yellow; with dilute hydrochloric acid (1:3). The former mixture on being neutralized with an alkali again gives a green solution on shaking with chloroform; the latter by the same procedure yields a blue solution.

### Engineering Notes.

The Philippine army has twelve Colt automatic guns, thirty-three Gatling guns, twenty-one 2-pounder mountain guns, twenty-two 12-pounder mountain guns, and twelve Sims-Dudley dynamite guns.

An official of the Spanish navy at Havana has made three attempts to sell the floating dry-dock at auction, but without success. The Spanish government has decided to tow it to Spain, as it is worth in the neighborhood of half a million dollars.

The New York Central and Hudson River Railroad has decided to equip five of its new locomotives now building with the Vanderbilt firebox, invented by Cornelius Vanderbilt. We have already described this firebox, and we are pleased to know that the railroad company is to make a further and more searching test of the device, which has already given such satisfaction.

A few years ago a sea wall was built at Barrow, England, to keep the sea from the workings of a mine, and it is now proposed to make an embankment 6,750 yards long to inclose about 170 acres of land under which the mine has been extended, the existence of ore having been demonstrated under that area. It is estimated that the work will cost nearly $3,000,000, but the ore is of the finest quality.

The application of salt to roadbeds will be tried this winter in New York. It is believed that salt will prevent the top soil from freezing, thus obviating the mud which invariably comes with the thaw. According to The Municipal Engineer, Prof. Burr, of Columbia University, says of the proposed experiment that the effect of salt would be to lower the temperature at which the surface soil would freeze, and it would also take up the moisture, and so, perhaps, do away with the mud. It is an experiment which is well worth trying.

A suit for $5,000 damages in each case has been brought against the Bridgeport Traction Company by an administrator of the two victims of the Stratford trolley disaster. The complainant in this case alleges gross and wanton negligence, imperfect roadbed, car, curves, guard rails, and overwork of motormen. The suit is commenced in view of a decision of Judge Wheeler in the Supreme Court just before the disaster, which held that under the State law practically only nominal damages could be obtained in a case where death was sudden and painless. The suit just brought will settle an interesting legal point.

One thousand eight hundred and thirty-three workmen are now engaged on the Assouan dam on the Nile on the Mohammed Ali portion, and 1,572 of these are natives. On the other portions, 5,983 are engaged, making a total of 7,816 employed in all. Excavations in rock and soft material are being carried on in the navigation channel, and at the side of the dam 14,035 cubic meters of masonry have been built; 466,000 bricks have been burned and 300,000 more are made, and a large quantity of stone has been quarried and dressed. At the Assiout barrage 12,000 men have been employed.

Tree and shrub planting along the Suez Canal to protect it from drifting sand is in progress. Reeds have been placed along about 9 miles of waterline of the canal proper and along the whole length of the Sweetwater Canal. These reeds are at first protected against the violence of the bank eddies caused by passing ships by fascines, while on the slopes and top of the banks of the Sweetwater Canal plantations of shrubbery have been set out. A system of irrigation has been organized for these plantations, the water coming from the Nile by the canals excavated when the ship canal was being built. The results so far have been very promising.

A short time ago, at the request of one of the Imperial Commissioners of Germany, the general passenger agent of the New York Central Railroad sent to Berlin photographs of the interior and exterior of our finest cars and other data in relation to the operation of American railways. Several other countries have asked for similar information, and there is a general awakening of foreign nations on the subject of transportation, brought about mainly by the wonderful achievements of American railways. Probably no one is better fitted to deal with the subject than George H. Daniels, whose very important address on American railroads is begun in the current SUPPLEMENT.

Discoveries have recently been made in the lava beds of New Mexico which throw a new light on the very complete systems of reservoirs and irrigation viaducts which were employed by the ancient inhabitants of that part of the country. Under the lava which covers hundreds of square miles are found traces of cemented ditches and reservoirs that are marvels of civil engineering. Ditches wind in and out at the base of the mountain ranges, following the sinuosities of the canals in such a manner as to catch all the storm water before it was absorbed by the loose sand at the mountain's base. Reservoirs at convenient places stored the water, which was led in cemented ditches across loose soil to the various points where it was required. Chasms were crossed by viaducts.

### Electrical Notes.

In Germany at points where there is danger of high-voltage electric currents, there is a conventional representation of a zigzag bolt of lightning. This is painted on transformer chambers, poles and similar places.

Aluminium feed wires will be used in the new Northwestern and Chicago Railway, and will consume 150,000 pounds of that metal. The feeders will be placed in a wooden box covered by a board walk between the double tracks, and will be supported on vitrified clay blocks placed about nine feet apart.

In both South and Central India the need of cheap power is specially felt, and in these portions of India are some of the grandest falls in the entire country. The falls of the Himalayas, in the northern part of India, could be utilized were they not too far from places where industries can be profitably carried on.

The Superintendent of the United States Geodetic Survey will have the "Pathfinder," the new vessel of the Survey, equipped with apparatus for the wireless system of telegraphy. The vessel will go to the Aleutian Isles, and it is thought that by the wireless telegraphy the difference in altitude of the islands will be determined accurately.

An electric rack-railway has been built at Laon, France, to connect the railway station with an elevated plateau 672 feet above the station, where most of the inhabitants live. The overhead trolley system is used in combination with a rack-rail track. Ordinary street cars are used seating forty passengers. The total cost of the line, which is a mile and a quarter long, was nearly $90,000.

That the system of transfers which obtain on the trolley lines in our large cities is too liberal is shown by the fact that in New York a newspaper reporter determined to test the possibilities of the transfer system. He succeeded in transferring unchallenged 107½ miles, making 87 transfers for a single five-cent fare. The ride occupied twenty-four hours. It is said that he could have gone still further had he so desired.

A new electric railroad is to be built in Northern Ohio, to connect the city of Toledo with Norwalk, about 60 miles. The road will be built according to good steam railroad practice. It is designed for a speed of at least 40 miles an hour, and will be worked from one central power station, a three-phase alternating current being used at high voltage. The current will be transmitted at about 15,000 volts pressure and will be stepped down and transformed at the substations.

An electric light wire in Brooklyn broke on October 31, and was inadvertently stepped upon by a boy. It immediately coiled around his neck and arms. A policeman took hold of the boy's body and tried to pull him away; but he was knocked unconscious by the shock, and if he had not been wearing rubber boots he would also have been killed. It was some time before an ax could be obtained, and another man was overcome before the wire was cut, and it was then found that the boy was dead.

The French government is considering the advisability of discontinuing the use of the guillotine and contemplates the adoption in its stead of electrical execution. The head of the criminal is inclosed in a helmet somewhat similar to that used by a diver. When the executioner turns on the current two needles leap from their sockets, penetrate the temples and enter the brain. A powerful alternating current ruptures and destroys the brain cells so quickly that it is believed that death will be instantaneous. This seems like a clumsy method of execution, but there is no question that it will be efficacious.

A very satisfactory test of the McElroy-Grunow improved third rail system was made at New Britain, Conn., on the tracks of the New York, New Haven and Hartford Railroad on November 9. An improved circuit breaking device, the invention of Mr. William Grunow, Jr., was shown in operation, and worked well. The circuit-breaker used to break the circuit as soon as the car passes over the section of track beneath it, consists of an electro-magnet placed in a box supported on a spring connection adjoining the track. The terminals of the coils of the magnet are connected, one by a circuit to the third rail, and the other to an additional energizing rail beside it. The contact shoe on the car as it enters a section closes the circuit between the third and energizing rails which causes the armature of the magnet in the box to be brought in contact with the top of the box, thereby connecting the main feeder current from the feed wire, hung on the poles, to the third rail, the current passing through the cores of the armature and the box to the third rail. The energizing rail is made in sections equal to a car's length, the ends being beveled to permit one end to pass the end of the adjoining rail. This allows the shoe to maintain constant connection between the section the car is leaving and the next section of track ahead. There is thus no danger of sparking or of the circuit-breaker burning out. There is the further advantage that the track is guarded against short circuits, and made less dangerous for persons or animals who may cross it.

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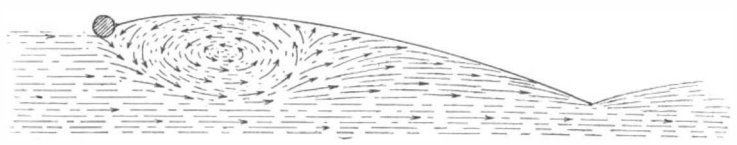
## Correspondence.

### WIND VORTEX IN SAILS.

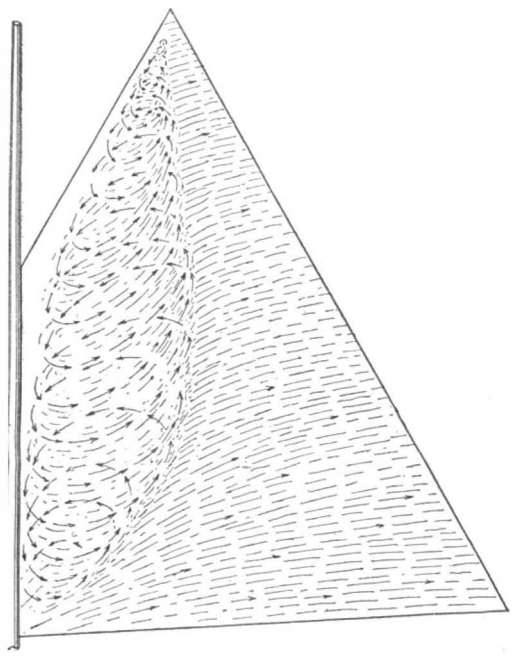
To the Editor of the SCIENTIFIC AMERICAN:

In connection with the theory advanced under the head, "Action of Wind on Sails," in a recent number, I desire to call your attention to the inclosed diagrams, illustrating a fact which I observed while sailing an iceboat in a snowstorm. No. 1 shows the



No. 1.

wind's circular motion caused by a bellying sail; like flowing water by a depression in the shore line, its course is reversed, and as air in a rotary motion attains greater velocity, it is plain to see its effect in forcing a boat to windward. No. 2 shows the vertical column of whirling air and the advantage this pattern of sail has for gathering a large volume. The working area of sails is materially increased, without detriment to pointing, by the use of a flexible boom, yielding laterally nearly in conformity with their curve; by this means the base will be broadened and exert itself over a larger portion of the sail. I have used flexible booms for both jib and mainsail for a number of years.



No. 2.

Advantages derived from gathering the vortex near the mast consist in a flatter leech, largely overcoming the tendency to backfill, less strain on the sheet, and consequently less lateral resistance on the rudder blade, points which I think many of your sailor readers will appreciate. S. D. TUCKER.

Troy, October 23, 1899.

### Eyesight of School Children.

To the Editor of the SCIENTIFIC AMERICAN:

I wish to thank you for bringing the subject, "The Defective Eyesight of School Children," before the public, and I hope it may be persistently agitated till the importance of it is fully understood and appreciated by the parents and educators of the land. In addition to what has been so admirably said, I am convinced from my own observation and from the testimony of others that one great cause is requiring so much to be learned from the blackboard, reading lessons, mathematics, etc., with defective light. Children sitting near or distant, often in an oblique position, the angle of vision imperfect, often a glare of light which almost obscures, there is a constant strain upon the eye in the endeavor to see distinctly. Even little tots five years old required to copy from the board their reading lessons when they do not know their letters, and number work not knowing one figure from another. I have been a scholar and a teacher. I know of no better way for children than to read holding the book and thereby enabling them to adapt their vision as required. It is a question whether so much writing is best for older children. Exercises of various kinds, mathematical work, examination papers, etc., all requiring close and earnest work on paper, which is very trying for the eyes. A mother of boys and girls, a woman of education, a graduate from Mount Holyoke Seminary, remarked: "It seems to be, with teachers and superintendents, an era of experimenting, but it is very hard on the children." A close observer has said he feared the day was coming when we would be a nation of blind people unless preventive and radical measures were adopted. MRS. M. B. SMITH.

### A Possible Explanation of Boiler Explosions.

To the Editor of the SCIENTIFIC AMERICAN:

The American journal, The Locomotive, informs us monthly of the great number of boiler explosions in the United States, numbering at an average each month about thirty, and the directly killed also about thirty, and the wounded are more or less. But the real cause of the explosion is not often discovered. It is not improbable that in many cases a cause existed which was not considered dangerous by the fireman, as, for instance, a case mentioned by the Metallarbeiter of September 27, 1899:

"It is a known fact that glass water gages may indicate a much higher water level than in reality exists. Each defect in steam tightness of the steam pipes leading to the top cock of the glass water gage, or a defect in tightness of said top cock, causes less pressure on the water in the glass gage. Consequently the water rises higher and higher in the glass in proportion to the defect in tightness of the steam pipe or cock. By a defect in a steam pipe leading to the top cock of a glass water gage was caused a difference of five inches in the water level of the glass gage and that in the boiler."

C. Remschel stated in the Technisch Zeitung that a magnetic water level indicator gave alarm of low water while the glass water gage showed four inches above middle water height. Everything was found in good order except a defect in tightness or soundness of a steam pipe leading to the top cock of the glass gage. The boiler after being fed with water till the alarm whistle was silenced, showed then the said differences in the water level. After remedying the defect in the steam pipe, the water level in the glass water gage fell six inches.

Likely such kind of defects as just mentioned caused many boiler explosions, since boilers are often intrusted to men lacking technical knowledge. And if in case of a terrible explosion the fireman escapes being killed and declares truthfully that the glass water-gage indicated sufficient water in the boiler, still the water may have been far too low, the boiler flues not covered with water—the danger of explosion not in the least visible to the fireman.

To bring such facts to general knowledge may not be amiss. L. OTTO P. MEYER, Ex-American Consul.

Dresden, October 31, 1899.

### Coming Eclipse of the Sun.

To the Editor of the SCIENTIFIC AMERICAN:

In the delightfully clear paper on the coming eclipse of the sun (see SCIENTIFIC AMERICAN, October 21, 1899, page 267), Professor Lumsden says that at the commencement of the total eclipse, "we lay down the position of planets, comets, if any, and of bright stars." A' against particular stars or planets would show which were visible.

Now all this takes time, and time is of supreme importance. Before the eclipse we know the position of the sun and of the planets and stars around. Why should not observers have maps ready of the stellar part of the sky in question? And record the effect of the eclipse on the map? Surely this would lessen the labor of observation while leaving the attention freer to follow the particular phenomena.

F. C. CONSTABLE.

Burward, Sussex, England.

### Accused of Fraud.

O. J. Bailey, publisher of The World's Progress, and proprietor of the American Patent Agency, at Cincinnati, O., has been on trial on a charge of using the mails to deceive and victimize patentees and dealers in patents.

In stating the case for the government the prosecuting attorney said that Mr. Bailey had been in the patent agency business in that city for twenty-three years, and that it was intended to show that his custom had been to write to persons as soon as their patents were announced in The Patent Gazette, offering to sell their inventions on commission, throwing out alluring suggestions as to values, all of which ended in demands upon the patent holders for $23 cash down in order, ostensibly, to advertise the patents.

This advertising was through The World's Progress, Inventors' Manual, and other publications printed by Mr. Bailey. The World's Progress circulation was given as 50,000 copies per issue, when, the government claimed, the actual number printed was never over 2,500; and similarly with the other publications, 6,000 circulars were promised when from 100 to 200 only were printed.

The whole arrangement, the government claimed, was simply to interest inventors by delusive hopes, get their $23 cash, and then be rid of them in the best way possible. One way for interesting the inventors was to write, telling them that, owing to the certain and manifest great value of their inventions, the patent agency was ready to reduce its regular commission for selling from 15 per cent to 10 per cent.

Witnesses from different parts of the country were called to prove the charges.—The Fourth Estate.

### Expense of Target Practice.

A single big gun of the many now being put in place for the protection of the sea coasts costs a large sum. Some interesting figures on this subject have just been submitted to Gen. Wilson, and will be by him transmitted to Congress.

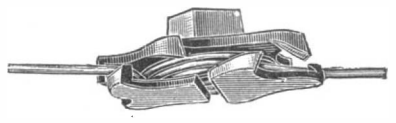
A 12-inch breech-loading rifle, with its disappearing carriage, costs $141,000; a 10-inch, $99,250; and an 8-inch, $72,000. The figures show that modern high powered guns cost immense sums of money, and the cost of firing them is proportionately as great. The report of experts who have inspected these guns and the devices for securing an accurate aim show that there is an immense saving effected by possessing modern range and position-finding devices.

"The demoralizing effect of a hit as compared to a miss," said one of these reports, "cannot be reduced to a money value, but it costs big money to shoot a big gun and then miss the mark. Take for instance the 12-inch gun. To miss the mark is simply to throw away $561.70. With the 10-inch gun the loss is $322.40, and with the 8-inch rifle it is $164.65."

### A SIMPLE DEVICE FOR TIGHTENING FENCE-WIRES.

In order to provide a means for taking up the slack of a loose fence-wire, Mr. William H. Mason, of Leesburg, Ohio, has devised a simple ratchet whereby the wire or cable can be restored to its former tautness.

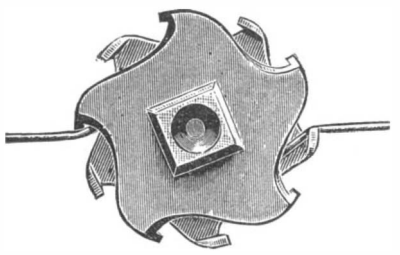
The device comprises mainly a front ratchet-wheel and a rear ratchet-wheel, the two being riveted together and rigidly connected by a hub on the rear



VIEW OF RATCHET SHOWING WIRE WOUND ON.

ratchet-wheel which hub fits into a corresponding recess in the front ratchet-wheel. From the inner faces of the wheels teeth extend inwardly, the tooth of one wheel being opposite a cut-out portion in the other wheel. The teeth have inclined backs and slanting front edges.

The wire is placed in a diametrical slot in the rear wheel, and the device is turned by means of a wrench applied to the squared hub of the front ratchet-wheel.



SIDE VIEW, SHOWING MANNER OF FASTENING THE WIRE.

The wire readily slips over the inclined backs of the teeth, and is wound up on the intermediate hub of the rear ratchet-wheel. When the desired tension has been secured, the wrench is removed and the wire snaps against the forwardly-slanting edges of diametrically-opposite teeth, and is thereby held firmly in position. The wire may also be slackened if desired.

It is necessary only to slip the slot over the wire and to turn the device to secure the desired tension; for the wire, after having been sufficiently stretched, automatically springs against the teeth to lock the ratchet-wheels in place.

### Vanilla Poisoning.

A certain fearful interest attaches to accounts of poisoning by substances in common use, and the interest becomes almost painful when we learn how difficult it is to provide against its occurrence. Vanilla is a case in point. Fortunately, thanks apparently more to luck than anything else, cases of poisoning from this cause are rare. Nineteen persons, one of whom subsequently died, suffered severely, Wassermann tells us, from the effects of eating some vanilla "cream." This was composed of milk, eggs, sugar, and flavored with vanillin (the commercial article prepared from coniferin). The dish had been cooked in the evening and allowed to stand, uncovered, in the dining room till noon next day. Investigation showed that the eggs and sugar were good, that the milk alone was harmless and that the vanillin was pure. The fact that the cook and landlady, who had merely tasted the dish, had also become seriously ill, suggested the idea that the poisonous agent might have undergone further development after being swallowed—that is, that it was bacterial. Wassermann boiled three flasks containing respectively plain milk, milk flavored with vanillin, and a solution of vanillin in water, then let them stand eighteen hours at a temperature of 37° C. (98·6° F.) Some of the contents of each flask were injected into mice. The milk flavored with vanillin was poisonous, the other two harmless.—British Medical Journal.

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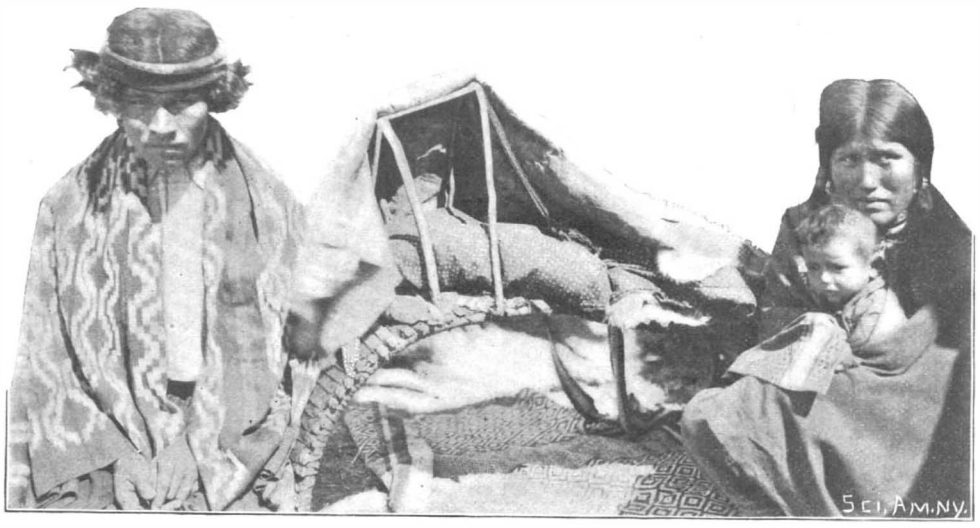
## EXPLORATIONS IN PATAGONIA.

BY PROF. J. B. HATCHER. PRINCETON UNIVERSITY.

The interest of the scientific world in the extinct life of Patagonia dates from the publication in the early forties of the reports of Owen and Sowerby on the collections of fossil vertebrates and invertebrates made in that region by Darwin during the voyage of the "Beagle," from 1833 to 1836.




**Tehnelche Man, Squaw, and Child.**

Notwithstanding the interesting and unique nature of most of the fossil mammals in Darwin's collection, so entirely different from everything known in the northern hemisphere, yet the interest aroused by his discoveries was permitted to subside, and for many years almost nothing was done toward bringing to light the exceedingly rich extinct fauna of this distant and little known land.

During the eighties interest was again attracted to this region by the explorations of Moyano, Moreno, Burmeister, Lister, and others.

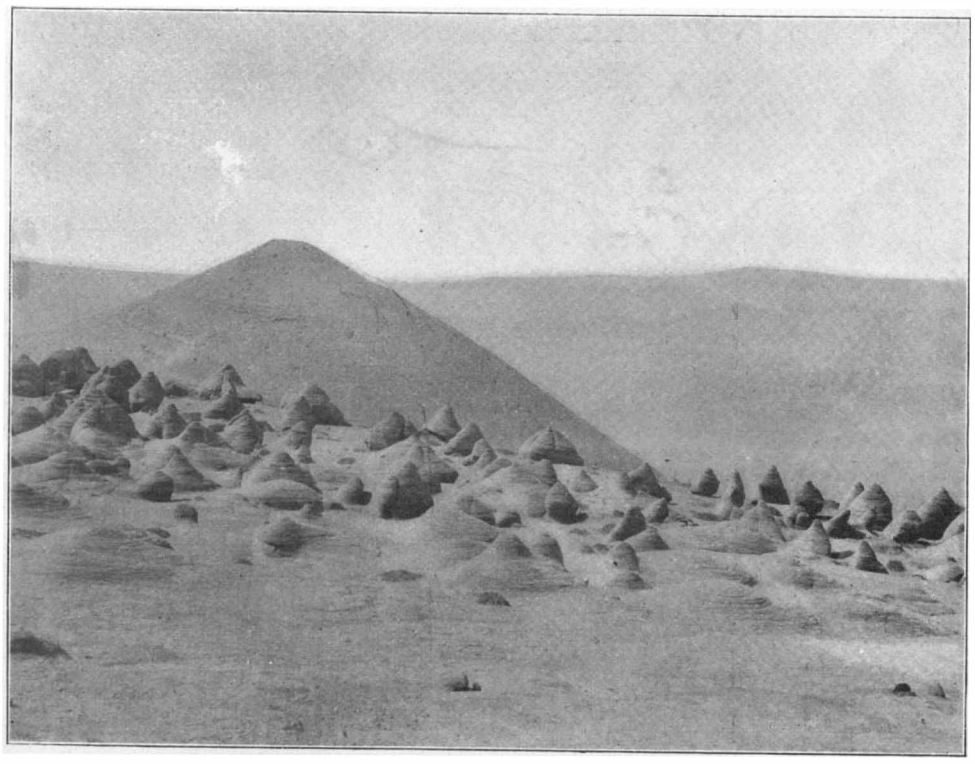
Interesting and important as were the results attained by each of these expeditions, they were really insignificant from a paleontological standpoint as compared with the brilliant achievements of Charles and Florentino Ameghino. The combined efforts of these two brothers will always stand as a monument to South American paleontology and as a substantial testimony of what men endowed with an enthusiastic zeal for their profession may accomplish even under most discouraging circumstances.

The beginning of the first systematic investigation of the paleontology of Patagonia dates from the first voyage of Charles Ameghino in 1887. Since that time a series of papers written by Dr. Florentino Ameghino upon material collected by his brother in the field have followed one another in rapid succession, each almost invariably announcing discoveries more remarkable than the preceding.

The discoveries announced by the Ameghinos were of such an interesting nature, and many of the conclusions drawn from them were so extraordinary and frequently so opposed to conclusions believed to be well established by observed facts in the northern hemisphere, that paleontologists everywhere agreed as to the desirability of bringing together a representative collection of fossil vertebrates and invertebrates from that region for study and comparison with collections from North America and Europe, and of making, in so far as possible, a detailed study of the geology of that region, sufficient at least to determine the exact sequence and relations of the different horizons, and of securing all data possible which might prove of use in correlating South American rocks with those of North America and Europe.

Since no one else seemed ready to undertake this work, early in the autumn of 1895 the writer decided to attempt it in behalf of the department of paleontology of Princeton University. Dr. W. B. Scott heartily approved of the plan when it was presented to him, and freely gave his energy and influence toward its accomplishment, while from several friends and alumni of the institution came most essential financial assistance. So that by March 1, 1896, I was able to sail with Mr. O. A. Peterson on our first expedition. Since that date the work in Patagonia has been continued with but occasional interruptions.

It would be quite beyond the limits of this article to give in detail the results of the work so far accomplished or to discuss any of the many controverted questions relating to the geology of that portion of South America. A brief account of the physiographic, geologic, and paleontologic features of the region, together with a summary of the more important results of the work so far accomplished, may be of interest to readers of the SCIENTIFIC AMERICAN.

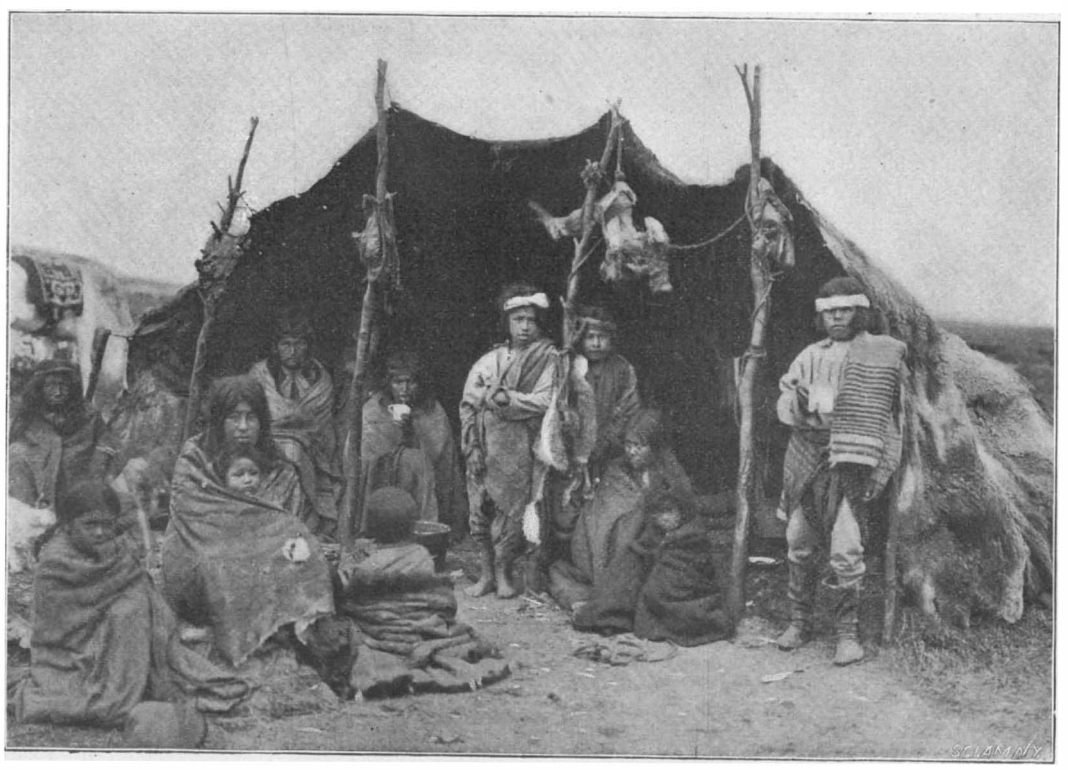


**Curious Wind and Rain Erosion in Andes of Patagonia.**

Physiographically, Patagonia is divided into two sharply defined regions—an eastern level and comparatively barren plain and a western exceedingly broken and mountainous region. The former extends eastward from the base of the Andes, where it has an altitude of 3,000 feet to the Atlantic coast, where it terminates in a continuous line of precipitous cliffs 300 to 400 feet in height.

Three distinct features characterize the topography and tend to relieve the monotony of the broad Patagonian plains. The first of these is the series of escarpments, from a few feet to several hundred in height, encountered at successive altitudes as one proceeds from the coast inland toward the Andes. These escarpments have a general trend parallel with the present coast line, and they doubtless mark successive stages in the final elevation of the land above the sea. The second feature is to be seen in the series of deep transverse valleys crossing the territory from east to west and constituting the present drainage system. In so far as my observations have gone, these are all true valleys of erosion. The third and perhaps most striking feature in the topography of eastern Patagonia are the volcanic cones and dikes, and the resulting lava sheets, which, covering extensive areas throughout the central plains, are seen capping most of the higher table lands and frequently descending well down the slopes into the present valleys, while the extinct volcanoes often rise majestically hundreds of feet above the surrounding plain.

In a line approximating the seventy-second meridian of west longitude, the Andes rise abruptly from the plains and form one of the most rugged and in many respects most picturesque mountain chains in the world. Many of the peaks attain an altitude of over 10,000 feet, quite sufficient at this latitude to precipitate most of the moisture in the atmosphere as it is forced over them from the Pacific. Owing to the southwesterly winds which prevail here throughout the year, the atmosphere during its long journey across the Pacific becomes saturated with moisture, which, together with the completeness of the precipitation brought about by the advantageous topography of the western coast, renders this region one with an exceedingly high annual rainfall and consequently luxuriant vegetable growth in striking contrast to the dry and comparatively barren eastern region, where the winds, already deprived of most of their moisture during their passage over the Andes, are usually dry and the annual rainfall correspondingly low. The prevailing winds in eastern Patagonia, as in western, are southwesterly, and an easterly wind of twenty-four hours' duration on the eastern coast is sure to terminate in a heavy fall of rain or snow.



**Tehnelches Taking Yerba.**

**PROF. HATCHER'S EXPLORATIONS IN PATAGONIA UNDER THE AUSPICES OF PRINCETON UNIVERSITY.**

Not all the moisture of the mountainous region is precipitated as rain, for in the higher Andes severe snowstorms prevail throughout the entire year, ample for the formation of great ice fields, from which extend numerous glaciers, many of which reach from the mountain summits far down below timber line, and some on the western slope quite into the sea. Formerly these glaciers were much more extensive than at present, and they doubtless contributed to the erosion of the exceedingly intricate system of mountain gorges and fiords now forming so conspicuous a feature of the region.

The slopes of the Andes below an altitude of 3,000 feet are covered with dense forests, especially on the western side. The variety of trees in the southern regions is very limited, and the quality of the wood for lumber or timber for building is poor. Two species of beech, Fagus antarctica and F. betutoides, the latter an evergreen, are much the commoner of the trees. The deciduous beech is especially abundant, and is the only tree found throughout extensive areas on the eastern slopes of the Andes.

Within the dense forests, lichens, ferns, mosses, and other cryptogams grow in great profusion, entirely covering the ground and trunks and lower branches of the trees. The delicate foliage and variety and har-

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mony of colors of these plants, always freshened by frequent showers, enhance the other natural beauties of this region, and give to the quiet depths of the forests a peculiar attractiveness, contrasting strongly with the rugged cañons and serrated crests of the higher Andes.

The most conspicuous animals of the forest region are a small deer, not quite so large as our Virginia deer, the male with usually only two points on either horn. The puma, or mountain lion, is abundant both on the plains and in the mountains. There are two species of dogs. The larger, Canis magellanicus, is about the size of a small collie, of a reddish brown color, and frequents the wooded regions. It is rather shy, in striking contrast with the smaller C. azare, abundant in the plains, of a light gray color, and about the size of a small red fox. The guanaco or South American camel is very abundant over the plains, and occasionally enters the wooded mountainous districts. Among the birds, two, from their size, are especially noteworthy, the rhea, or so-called ostrich, found in great numbers on the plains, and the condor, common in the Andes, along the high bluffs of the sea coast and about the basalt cliffs of the interior plains region.

The natives of the eastern and western regions belong to two entirely distinct races, differing from each other in their customs, language, and mode of life. To the eastern region belong the Tehnelches, a large, well developed, and peaceable race, living entirely by the chase. They construct their habitations and make their ample clothing with considerable skill from the skins of the guanaco. In the capture of the guanaco, rhea, and other game animals and birds they are exceedingly proficient and show much ingenuity.

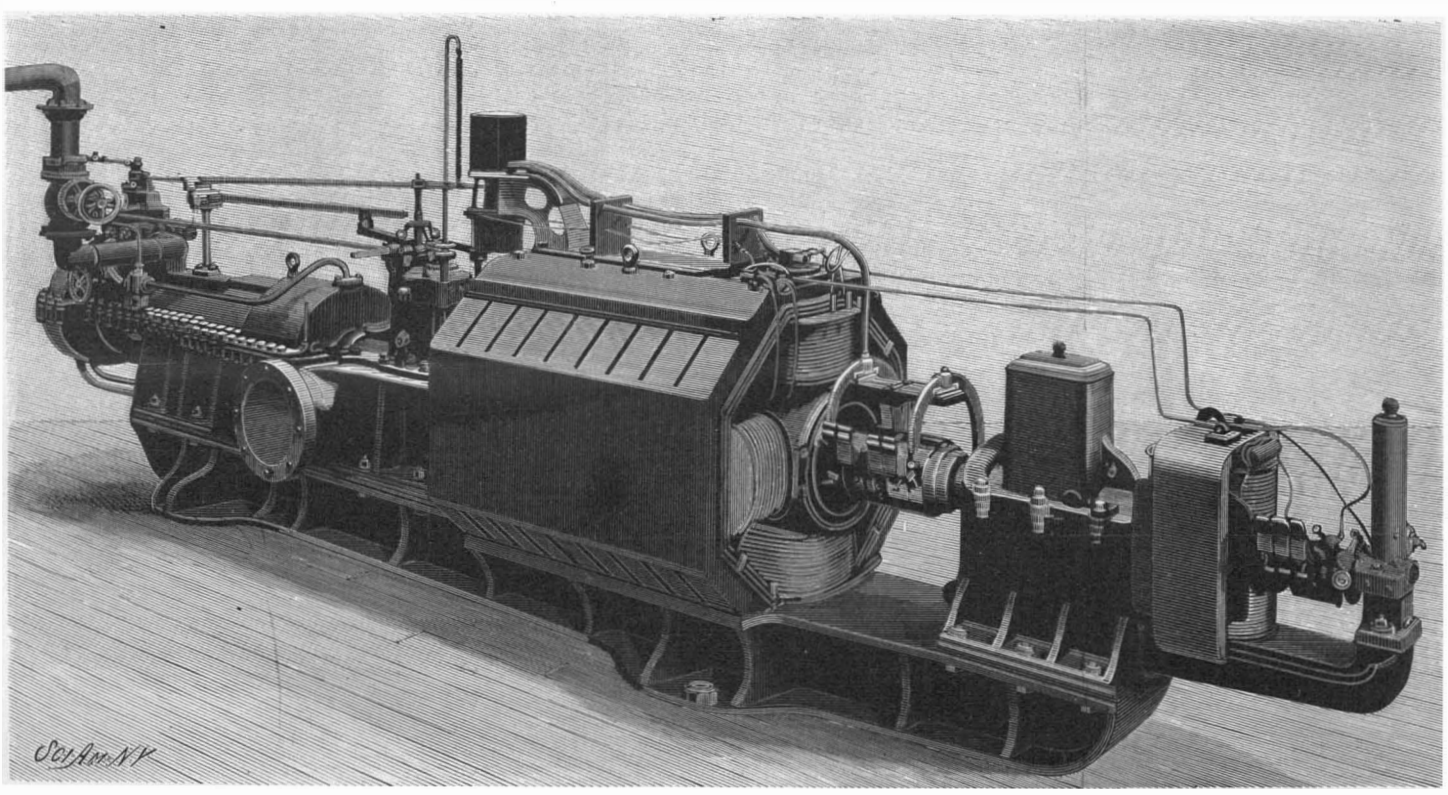
The Channel Indians of the western region are physically much inferior to the Tehnelches. They are essentially a maritime people with all their activities clustering about the shore, from which they never proceed more than a few miles inland. They subsist chiefly upon shell fish, the flesh of seals, fish, and the sea otter and a few edible fungi indigenous to the region they inhabit. From the skins of the seal and sea otter they construct their clothing, usually exceedingly scanty, notwithstanding the inhospitable climate. Rude huts are sometimes built from the branches of trees, but they spend much of their time in small open boats made of beech bark sewed together with whale bone. It is in the construction of their boats and the implements used by them in the capture of seals that they show greatest skill and resource.

Although the plains of eastern Patagonia are exceedingly monotonous and uninteresting to the casual observer, yet they are of the greatest interest to the geologist and paleontologist, for it is the rocks composing them that contain the remains of the extinct animals that in former times inhabited this region. In many places along the river valleys there are extensive exposures of the sedimentary rocks rich in fossil remains, and the high bluffs of the sea coast have proved among the most promising localities for the collector.

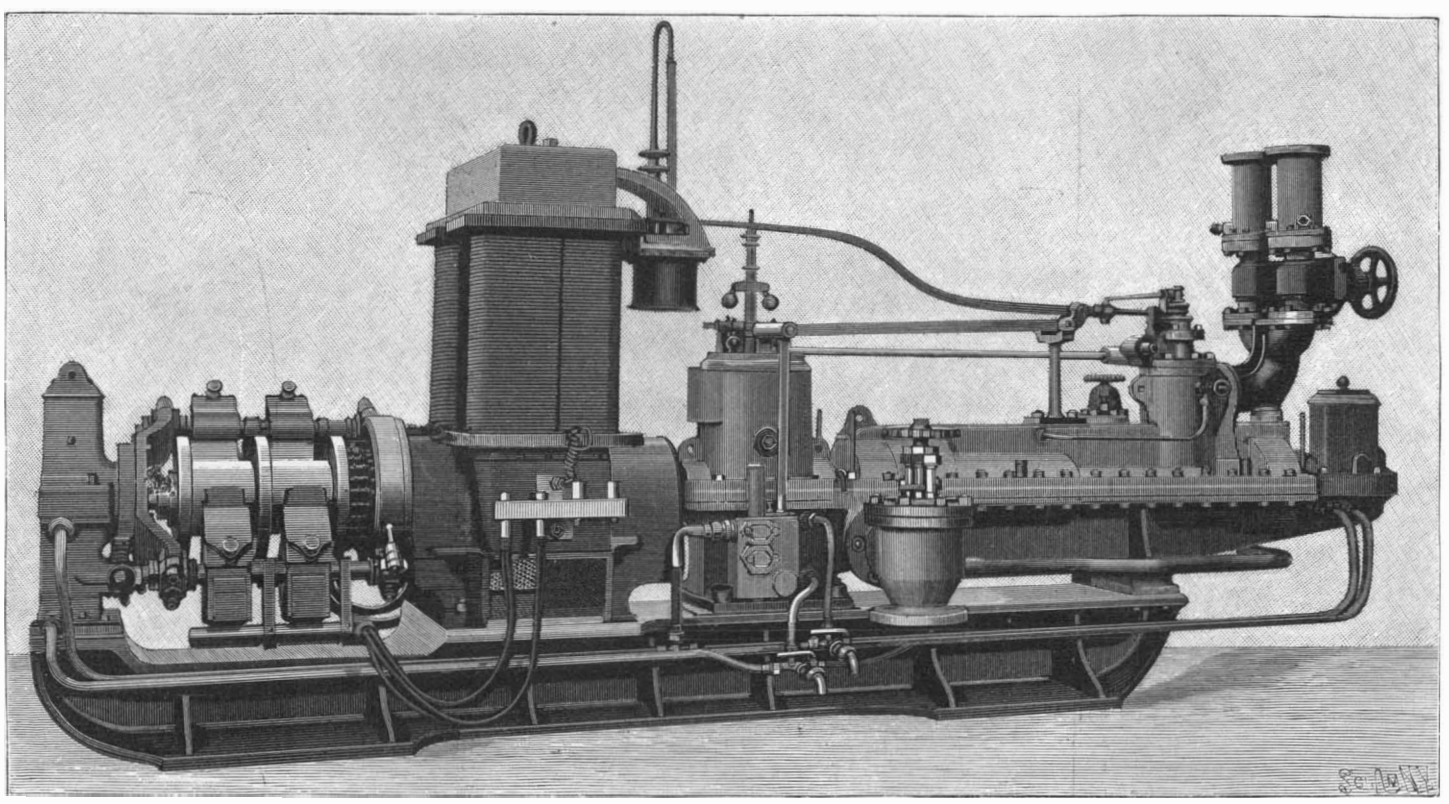
A careful examination of many exposures in various portions of Patagonia has made it possible to establish the exact sequence of the different strata and to give a section of the various formations with the fossils characteristic of each from middle Mesozoic to recent times, and to indicate approximately the present geographical distribution of these different formations throughout Patagonia.

Rich and varied as was the mammalian fauna of South America in former Miocene times, the excellent preservation of many of the skeletons in our collections demonstrates beyond a doubt its unique character, so entirely distinct from anything then living in the northern hemisphere.

While there is a striking and universal dissimilarity between this fauna and that of the northern hemisphere, on the other hand there are many apparently close resemblances between the extinct Patagonian fauna and the recent Australian fauna. The same is also true, though in a more restricted sense, of this fauna and that of South Africa. The explanation of these similarities and dissimilarities in the faunas of the various regions can be best explained by assuming that they indicate in the one case a direct relationship and in the other a totally distinct origin for each. The relations apparently existing between this Patagonian fauna and certain forms now living in Australia and Africa would be the natural result of former land connections between these regions, perhaps, by way of an Antarctic continent permitting of an intermigration of species. The dissimilarity in the North American fauna would indicate a long period of isolation of the two Americas, continuing until comparatively recent tertiary times.



75-KILOWATT TURBO-GENERATOR AT THE HOTEL CECIL, LONDON.



350-KILOWATT TURBO-ALTERNATOR AND EXCITER AT THE METROPOLITAN ELECTRIC SUPPLY COMPANY'S STATIONS.

## THE PARSONS STEAM TURBINE.

Although the Parsons steam turbine is identified in the public mind with high-speed torpedo boats, it is a fact that long before the "Turbinia" made her phenomenal speeds the Parsons turbines had been doing highly successful work on land, more particularly in connection with electric light and other electrical installations.

The Hon. Charles Parsons is the son of the late Earl of Rosse, whose great telescope, erected on his estates in Ireland, has long been one of the scientific landmarks of the age. His first successful invention was an epicycloidal engine, in which the cylinders revolve on a trunnion at half the speed of the crank-shaft. It enabled a perfect balancing of the moving parts to be obtained with a resulting high-speed rotation, and in this respect the invention may be regarded as forestalling the present demand for high-speed engines. In 1884 Mr. Parsons commenced the designing of a compound steam turbine and a dynamo with a working speed of 18,000 revolutions per minute. The preliminary experiments showed the necessity for bearings that should be somewhat elastic, and to meet the case the form of bearings shown herewith in Fig. 1 was designed. It consists of a gun-metal tube in which the shaft is rotated, and on this tube are threaded washers which are alternately larger and smaller in size, the smaller ones fitting the bush and the larger ones for the metal standard of the bearing. The whole series of washers is pressed tightly together by a spiral spring and a nut on the bush; one wider washer which is threaded on last fits both bush and standard and forms a fulcrum, with the result that when the shaft deflects a certain amount of elasticity is provided by the shaft itself, though the washers restrict the amplitude of vibration and bring the running to a steady rate about the principal axis of the rotating mass.

This form of bearing was abandoned in 1890 in favor of the simpler arrangement shown in Figs. 2 and 3. It consists of three concentric tubes of brass or steel fitting easily within each other, the oil between the tubes forming a self-centering cushion which has a considerable effect on the vibrations of the shaft. The tubes answer the purpose of the separate washers in the older form of bearing, with the added advantage that the tubes show no signs of wear, the oil film between them being preserved under all conditions of service.

The first successful steam turbine dynamo was constructed in 1885. It was operated at a speed of 18,000

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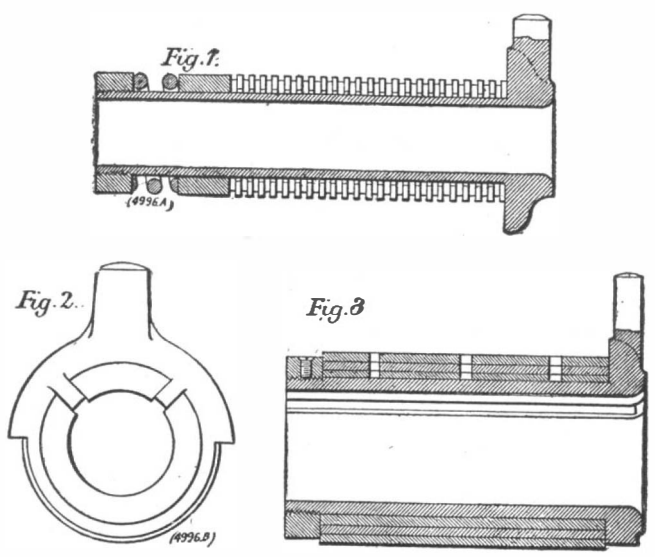
revolutions per minute for several years, and was quite successful. In this turbine provision for expansion was made by merely angling the vanes, but in subsequent plants both the height and the angle of the blades were varied and a more perfect range of expansion was thereby obtained. The first turbo-engine was put on board ship in 1885, and the first land engines of the kind were made in 1886. One of the latter is still at work. The first condensing type of steam turbine was constructed in 1891 for the Cambridge Electric Supply Company, and in the test by Prof. Ewing the results proved the compound condensing steam turbine to be about the equal of good compound condensing engines in regard to steam and consumption. In 1893 work was commenced upon the torpedo boat "Turbinia," whose remarkable performances are already familiar to the world. The highest speed achieved at any time by this little boat was between 34½ and 35 knots, and on a run of two miles she is credited with a speed of 32·76 knots under a boiler pressure of 210 pounds and with revolutions of over 2,000 per minute. It should be mentioned that on this occasion, owing to the use of a steam pipe too small for the capacity of the turbine, there was a drop of pressure of 50 pounds between the boiler and the engine.

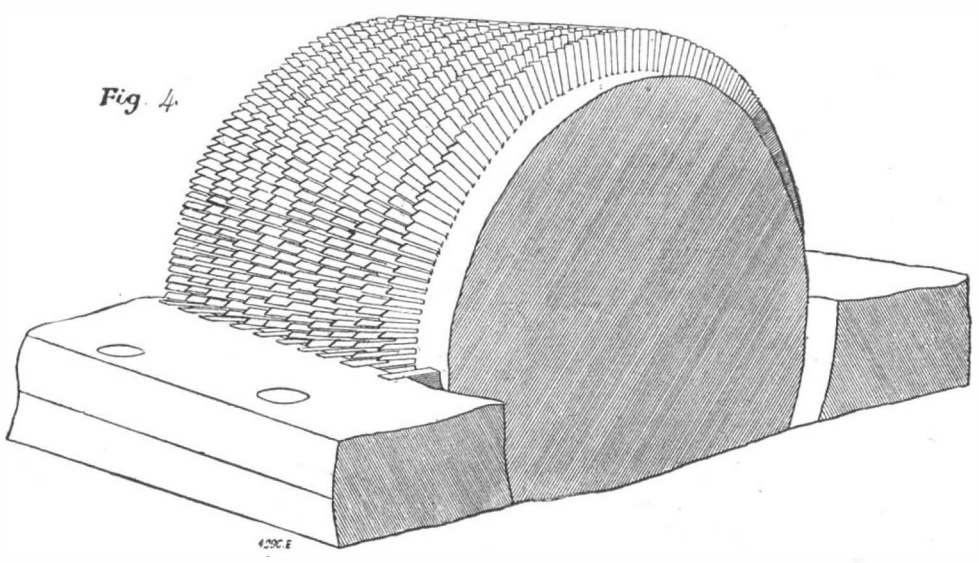
Fig. 4 is of special interest as showing the arrangement of the moving blades and guide vanes in the Parsons turbine. The top outer cover has been removed and the revolving barrel into which the blades are keyed is shown. The cylinder containing the revolving barrel has a larger internal diameter than that of the drum. The flow of the steam is through the annular space thus formed, this space being filled with the fixed guide blades and the revolving blades on the drum. Between each two rings of the moving blades there is one ring of the guide blades, the latter being keyed into the containing case of the cylinder. Steam is admitted to the annular space, and is directed by a ring of the fixed blades in a direction spiral to the axis of the revolving barrel. It then strikes a ring of the revolving blades on the barrel, which are set at such an angle that the steam acts on them as wind on the sails of a windmill, thus causing the barrel to revolve. Then another set of fixed guide blades rotates the flow of the steam and directs it onto a second set of revolving blades, the process being continued throughout the full length of the annular space until the exhaust is reached.

As a result of the fact that an increase in the size of the steam turbine is accompanied by a corresponding increase in efficiency, the size of the turbine has grown very rapidly, until to-day the average turbine has a capacity of about 300 horse power, while turbine plants of 4,000 kilowatts output are being designed under the Parsons patents. In the turbine engine, as in the multiple-expansion reciprocating engine, it is essential for the best results that the capacities of the cylinders should be proportionate to the various stages of the expansion of the steam; and it is one of the many advantages of the Parsons compound turbine that any ratio of expansion can be obtained without a material increase of weight or bulk. In the larger condensing turbine motors now being built for marine propulsion the ratio of effective expansion within the engine is between one hundred and two hundred fold. It is just here that we find the explanation of the satisfactory results which have been obtained in the larger turbo-engines.

In the steam turbine increased expansion is obtained by extending the length of the blades and increasing the diameter of the turbines, which results, of course, in increasing area acted on by the steam. One of our illustrations, for which, in common with the other cuts and the data accompanying this article, we are indebted to The Engineer, of London, represents one of the thirteen 350-kilowatt turbo-alternators, which are now in use for the lighting of London at the Metropolitan Company's stations at Manchester Square and Sardinia Street, while another engraving represents a 75-kilowatt turbo-generator, four of which have been installed at the Hotel Cecil, London.

While the steam turbine has been chiefly used for driving electric generators, it has found a wide range of application for other purposes. Thus, it has been found that a centrifugal pump when somewhat modified is equally efficient, whether it is run at 1,200 revolutions or at 3,200 revolutions. An ordinary 6-inch pump at 1,200 revolutions will give a lift of about 40 feet, but the modified pump at 3,200 revolutions will give a lift of about 200 feet with proportionately greater output. Hence, combining such a pump with a 100 horse power turbine provides an effective arrangement specially suited to mining purposes. A plant recently erected is lifting 850 gallons per minute, at a lift of 160 feet, when run at about 3,300 revolutions per minute, and it is giving excellent results. The turbine is also being successfully used for ventilating purposes, and also for induced and forced draught. In both of our illustrations just referred to the method of governing adopted in these turbines is shown. The governing may be effected by an electrical governor or by a centrifugal governor. If constant speed is required, a centrifugal governor type is adopted, but if constant voltage is desired the electrical governor is used. In the latter the voltage is automatically controlled with such accuracy that any desired voltage can be obtained at either full load or low load to within one per cent without altering the governor. In both types of governor one end of a lever is moved vertically either by the centrifugal governor or by a core controlled by a spring and actuated by a solenoid in shunt with the terminals of the machine. A suitable connection is made from the lever to a small valve, which, by a steam relay arrangement, acts through a small piston on the main admission valve.




DETAILS OF THE PARSONS TURBINE, SHOWING FLEXIBLE BEARINGS (1, 2, 3) AND INTERIOR OF TURBINE (4).

### Inventions That Are Unused.

One of the best mechanical engineers in New Orleans told an interesting story apropos of the tribulations of inventors to a representative of The New Orleans Times-Democrat. "About three years ago," he said, "I got up a little device that greatly simplified the working of a certain type of pump. I took out patents that cost me in the neighborhood of $300, including attorney's fees, and finally submitted the thing to a big manufacturing concern in the North. The proprietors at once conceded the merit of the invention, and offered me $500 down and a royalty of $125 on each one used. The cash payment amounted to nothing; for it really fell short of covering my time and expenses, but the royalty was generous, and I figured it out that it would yield me an income of $3,000 or $4,000 for several years—perhaps longer. It depended on how soon something better entered the field. Accordingly I accepted the proposition and transferred all my right. Now, how much do you think I actually received? Not a penny! No, I haven't been cheated; at least all the accounts have been perfectly straight. The trouble is they never put the device on the market. They simply stuck the patents and drawings in a pigeonhole and there they remain to this day. Why did they do it, did you ask? To save money. The public is very well suited with their pump as it stands, and it is doubtful if they could get any more for it with my improvement added. Such a step would merely cut down the net profit, so they prefer to let well enough alone. It was necessary, of course, to get my invention safely shelved, or it might have been taken up by some enterprising rival, and the only earthly reason for spending $500 on the thing was to put it out of the way. It was rather rough on me, to be sure, but the experience was valuable, and I won't get caught that way again."

[NOTE.—The experience of the pump inventor, as told by himself, exemplifies a trick too frequently resorted to by manufacturers to protect themselves against competing concerns who might acquire the patent and use it to their disadvantage. Patentees, when granting licenses, should stipulate that a royalty shall be paid on not less than a certain number of the article, whether manufactured or not, or in lieu of royalty, a stated sum sufficient in amount to deter the pigeonholing of the agreement.—ED.]

### The Cocoa Palm and its Products in the Philippine Islands.

There are several species of cocoa palms growing in the archipelago, but the ordinary cocoanut tree (Cocos nucifera) is the most important. The Indians make use of it in a good many ways, but only the principal ones need be enumerated. The kernel of the nut they use for food, while the liquid the shell contains makes a refreshing drink. If allowed to stand for some time, this liquid forms a very agreeable milky juice, that is relished not only by the natives, but by Europeans as well. After this juice has coagulated, it is mixed with sugar and made into bonbons, known as cocoa sugar, and also into various other delicacies. According to a recent report of the United States Department of Agriculture, by tapping the central bud that crowns the cocoanut, a kind of wine, called tuba, of an agreeable pungent taste, is produced. This tuba, when allowed to ferment, produces vinegar, and when distilled, a kind of brandy, that is highly relished by the natives. From the husk of the cocoanut the Tagals make ropes and cords, and a material for calking their boats. From the woody shells they carve spoons, cups, beads for rosaries, and many other articles. The leaves they use to cover the roofs of their houses. Roofs made in this manner are thick and tight, but they have the disadvantage of burning readily, so that in the towns and villages where the houses are thus covered, conflagrations spread with great rapidity. The veins and smaller ribs of the leaves are used to make brooms, the midribs serve as fuel, and the ashes are utilized in making soap. The trunk of the palm is made to serve as a pillar to support the houses that its leaves overshadow. Oil barrels, tuba casks, and water pipes are fashioned from hollow sections of the trunk. From the roots the natives extract a red dyeing material, that they chew in place of the areca palm nuts or bonga when the latter cannot be procured. Large quantities of cocoanut oil are manufactured in the Philippines. This oil is much prized by the natives. The men and women both use it to anoint the thick growth of hair that adorns their heads, and it thus finds a ready sale at remunerative prices. It is also used in the lamps that take the place of gas-burners in the streets, and in those used by the natives and Chinese in their houses. Manila exports annually about 150,000 pesos (£25,000) worth of cocoanuts to China and British India, and about 30,000 pesos (£5,000) worth of cocoanut oil to China.—Journal of the Society of Arts.

THE wonderful ability of the Japanese is shown by the fact that almost everywhere in that country English and American instructors in the colleges and factories are being supplanted by natives. They wish it plainly understood, says Commercial Intelligence, that Japan is for the Japanese. A student at the university planned a work of great interest. He conceived the idea of building a canal to connect two lakes of different altitudes. He tunneled mountains and overcame other difficulties, but the chief point of interest lies in the fact that he built a railroad over which the canal boats were transported as they left the water to the next lake. Electricity was used, and enough was generated to light the city of Kioto and furnish power to sixty factories.

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### Automobile News.

Work has begun at Hartford on an automobile which is intended to tow canal boats on the Erie Canal. It will be built on entirely new plans, and it is intended to be powerful enough to tow from six to ten canal boats at once. It will cost more than $4,000, and if it is successful other boats will be built.

According to the tests conducted by the Liverpool Self-Propelled Traffic Association, a car capable of carrying a load of 3 tons 12 cwts. was actuated at a cost, for fuel, wages, etc., of a cent a mile. The average cost for keeping such a vehicle in repair and also the expense of operating it amounted to $1,980 per year. It makes the average cost 3 cents per net ton per mile. Horse-driven wagons cost 18 to 24 cents per ton mile for doing the same work.

One hundred thousand francs have been voted for the construction of a track and a grandstand at Vincennes for the use of automobiles. Special prizes will be given in addition to the medals and diplomas which will be awarded by the exposition. The carriages and wagons will be divided into four classes, heavy trucks, cabs, victorias, and voiturettes. The last class will include tricycles and motocycles. An electric charging station will be provided near the race course, so that the electrical machines will have no difficulty about the supply of motive power when they need it.

A public hearing on the admission of automobiles to Central Park, New York, was held before the Park Commissioners on November 9. Fifteen advocates and ten opponents appeared to make speeches. Ten minutes was allowed the first three speakers on each side and five minutes to the rest. One of the best-known horsemen in New York, Mr. Lawson N. Fuller, said that he had driven four, six, and eight horses around automobiles without inconvenience. "A good driver in two days could accustom any horse to an automobile. Ninety-nine runaways out of a hundred are due to carelessness on the part of drivers. Green horses soon become accustomed to city noises, and there is no reason for keeping automobiles out of the parks." Ex-Magistrate Simms said: "The same question has been agitated in regard to the locomotive, the bicycle, and the elevated railroad. The horse became accustomed to all these. It must get use to the horseless carriage. The automobile must win in the end. There will be a legislative enactment, if the owners do not gain their rights in any other way." Some of the opposition, such as liverymen, etc., protested against giving horseless vehicles permission to enter the park. The decision of the board will be announced later.

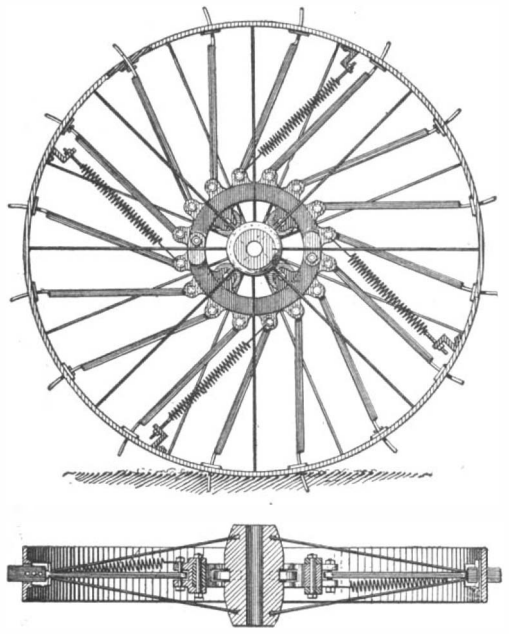
The automobile parade of November 4, in New York city, while not as extensive as might be desired, was important as showing how much public interest is shown in the new vehicles. When The Chicago Times-Herald race of 1895 is remembered, it demonstrated that the progress was substantial. The run was organized by The Automobile Club of America, and the course was about twenty miles, all on Manhattan Island. The parade formed at the southern side of the Waldorf-Astoria, and the start was made at 2 P. M. without confusion or delay, and for many blocks along the line of the run there was quite a crowd, and along the entire route there was a sprinkling of spectators. About thirty vehicles took part in the run, and they were all of well-known American types and makes with a few foreign carriages and motocycles. Most of them were of the open top variety. The drivers of the carriages and their guests were dressed in ordinary costumes, herein showing their good sense, for most French automobile outfits are ugly in the extreme. The carriages all behaved admirably, and while they ran through crowded streets the trip was made without accident and no horses were frightened. Electricity served to drive fifteen of the carriages, there were at least seven gasoline-driven vehicles, while four were propelled by steam. The latter were generally considered by the crowd to be the most picturesque on account of the exhaust, which was all but noiseless. Adjutant-General Avery D. Andrews led the procession and reviewed the carriages at Grant's Tomb in Riverside Park.

### An Instrument for Locating the Direction of Sound.

A new instrument has been designed by Mr. Cowper-Coles, of London, for readily locating the direction of sound and for projecting sound long distances. It consists of a reflector mounted on an arm which can be readily turned on its center and depressed or elevated by the operator. When it is desired to ascertain the exact direction from which a sound emanated the apparatus is turned on its axis, and as soon as the reflector is opposite the source of the sound it is heard much more intensified in the receiver. Two instruments are used to carry on the conversation between two distant points or ships. The sound waves are thrown from one reflector to the other, the sound being focused in one instrument in the receiver when the operator speaks into the flexible tube, while the operator working the other instrument places the tube attachment to the receiver to his ear.

### A TRACTION-WHEEL OF IMPROVED FORM.

The traction-wheel which we illustrate is the invention of Clarence Groseclose, of Sylvia, Kan., and is particularly adapted for traction-engines, automobiles, and harvesting-machines. Surrounding the hub of the wheel is a ring carrying rollers which bear upon the bottom of a groove formed in the hub. Arms pivoted to lugs on the outer side of the ring extend



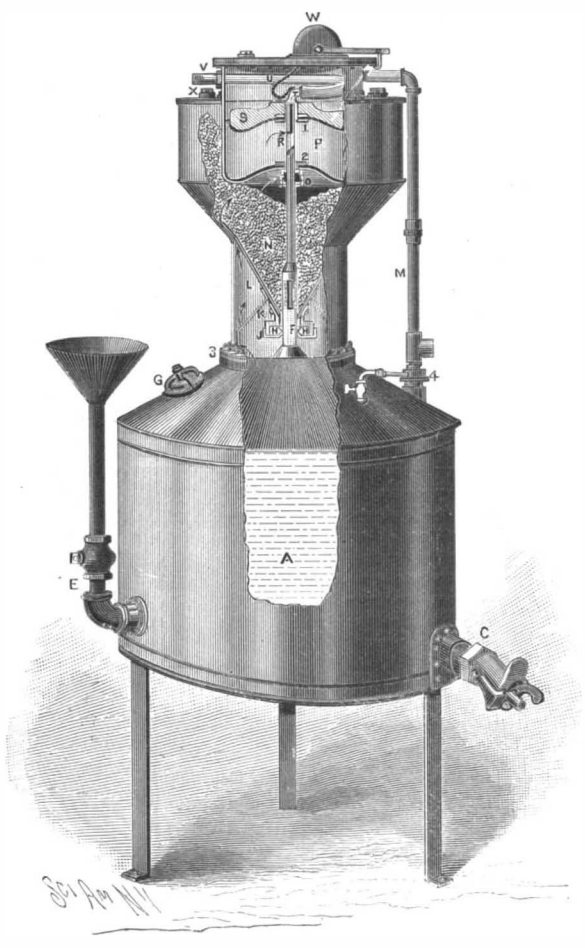
THE TRACTION-WHEEL IN SIDE ELEVATION AND SECTION.

outward tangentially to the ring and carry at their free ends blades which project through openings in the rim and which adapt themselves to the nature of the ground—hard or soft—over which the wheel must travel. Some of the blades are provided with stop-pins passing through holes in the arms; the blades are thereby prevented from moving too far outward. Springs are connected at their inner ends to the ring and are adjustably secured at their outer ends to brackets on the rim.

Should the wheel travel over hard ground or bridges, the blades, as they engage the ground or floor, will be forced inward, causing the ring to rotate on its bearing-rollers. Upon reaching soft ground the blades will be moved outward by means of the springs, acting upon the ring, so that they will engage in the ground. By arranging the arms at a tangent, the bearings formed upon the ring will be at one side of its vertical center line, thus insuring the rotary movement of the ring mentioned.

### THE "BECKLIGHT" ACETYLENE-GAS GENERATOR.

Few industries have experienced a growth so rapid as the manufacture of acetylene-gas generators. When



THE "BECKLIGHT" ACETYLENE-GAS GENERATOR.

the production of calcium carbide was made a commercial possibility by the Willson process, a host of machines sprang up, which, as in most early forms of apparatus, were crude in construction and often wrong in principle. Gradually manufacturers began to investigate and apply the principles which should govern acetylene generation, and which would insure the safe and cheap production of the new illuminant. Of the many forms of apparatus constructed with a view of meeting these requirements, we may mention a machine made by the Acetylene Generator Manufacturing Company, of 106 Bell Block, Cincinnati, Ohio, a machine which is the result of no little study on the part of the inventor and makers.

The "Becklight," as the improved apparatus is termed, consists of a slaking-chamber, *A*, a gasometer, *P*, and a carbide-chamber, *N*, which communicates with the slaking-chamber by an opening having a yielding valve-seat, *H*, adjusted in position by a screw-cap, *J*. Through the valve-seat, *H*, a feed-plunger, *F*, passes, which is connected with an elbow, *T*, secured to a connection, *U*, for the gas-outlet. The carbide feed is locked by means of a lever and sheave connected with the elbow and contained in a housing, *W*. The stem of the feed-plunger, *F*, is provided with four indentations for feeding carbide, and with a passage, *R*, to conduct gas to the service pipes. At the lower end of the carbide-chamber, a condensing-chamber, *K*, is arranged, which also provides a drying-space, *L*, through which the gas passes upwardly. To force the gas through the pipes and regulate its pressure a counterpoise, *S*, is secured to a gas-bag.

In operating the machine, the gas is first shut off from the service pipes and the lever operated to lock the feed mechanism. After the residue is removed from the water-chamber, water is introduced. The generator is then entirely closed by shutting the various valves; and carbide is introduced by removing the plugs, *X*. After releasing the feed-mechanism by means of the lever and sheave, the generator begins to work by pressing gas out of the gasometer, thus lowering the feed-stem so that its indented portion passes the valve-seat, *H*. An opening being formed, the carbide drops in a circle to the water below. The pressure of the resulting gas naturally seeks the point of least resistance, which is that side of the gasometer exposed to the atmosphere. The gas therefore passes up first against the condensing surface, *K*, depositing its moisture on the cold surface, then through the reduced inlet between the lower edge of the surface, *K*, and the outside generator wall, into the drying-space, *L*, thence into the carbide-chamber as shown by the arrows, through or over the carbide, whereby it is both screened and dried, into the passage of the stuffing-box, *O*, and finally through the passage, *R*, the hollow elbow, *T*, and the connection, *U*, into the service-pipe, *V*. If the consumption fall off, the inflated gasometer forms a cushion for the weight, *S*, thus locking the feed-mechanism until the amount of gas in the gasometer, *P*, is reduced.

The weight, feed-stem and gas-bag being integral, no gas can possibly pass into the gasometer without at once closing the feed-opening. The gas is resisted by the weight, *S*; and when the pressure is excessive, the weight is raised.

It will be seen from our illustration that the carbide and slaking-chambers are so arranged with respect to each other that the apparatus is far more compact than most others of the same class. The carbide is fed into the water in small quantities; for it has been found that the gas thus generated is cool and free from the dangerous benzine and other hydrocarbon vapors which always accompany the gas formed by generators operating on the dripping system.

### The Current Supplement.

The current SUPPLEMENT No. 1246 has many articles of great interest. "The Strike at Creusot" describes one of the most remarkable labor troubles of the century. The "Schneider-Canet Naval Turret" is an article illustrating in great detail the system which is largely used in French and other navies. "American Railroads—Their Relation to Commercial, Industrial and Agricultural Interests" is an address by G. H. Daniels, general passenger agent of a great railway system. It is a most interesting and important paper. "Gaston Tissandier" is a biographical article dealing with some of the important work of this French scientific editor. "Mechanical Science" is a continuance of Sir William White's important address. "The Pollak-Virág System of High-Speed Telegraphy" is a technical description of the new system. "The Test of the Marconi Wireless Telegraphy in the United States Navy" deals with some of the most important experiments which have ever been tried on the subject. It is illustrated by engravings made on the war vessels. "Stream Measuring in the United States" is continued and is elaborately illustrated.

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## RECENTLY PATENTED INVENTIONS.

### Agricultural Implements.

CORN-HARVESTER.—Paoli B. Horner and Clarence E. Hedrick, Clements, Kan. The heads of Kaffir corn ripen long before the fodder is ready to be harvested; and if the heads are left on the stalks until the fodder is fit for cutting, the seed shells off. The present invention provides a machine which is adapted to gather the heads at the proper time, leaving the stalks to mature. The machine is capable of adjustment for cutting tall or short stalks and of being worked by a single horse with one driver. When the machine is in operation the cutter may be elevated or depressed to top stalks of unequal height.

### Electrical Apparatus.

ELECTROMEDICAL APPARATUS.—Marcy L. Whitfield, Memphis, Tenn. In apparatus for the treatment of diseases of the body, it has been impossible to obtain good results, because the current used was generated by outside means and passed into the body, so that it was conducted by the blood and not by the diseased portions, except those over which it had to pass on entering or leaving the body. By means of this new apparatus the entire body or any desired part can be treated by causing induction to take place in the diseased part, so that every particle of the body when placed within the influence of a changing magnetic field, interrupts lines of force to generate electricity and to form a conductor.

BURGLAR-ALARM.—Daniel L. Wartzenluft, Kutztown, Penn. The wires of the circuit of the alarm extend across a window or door. One of the wires carries a circuit-closer. Auxiliary circuit-closers have connection with the wires and comprise spring-pressed levers mounted on insulated plates with which levers the wires are connected. Spring-pressed contacts carried by the window-sash, have electrical connection with the plates. The circuit is closed and the alarm automatically actuated by the breaking or jarring of the window-pane, door panel, or transom across which the wires are stretched.

TROLLEY-POLE.—Silas Vernoy, Toronto, Canada. In ordinary trolley systems, in which the rail is used as the return conductor, the current leaks and destroys by electrolysis the neighboring water and gas pipes and the steel foundations of large buildings. The company also loses much by the leakage of the current into the ground. As the inventor of this improved trolley-pole employs a separate pole for the incoming current and a separate wire for the outgoing current the defects referred to are remedied. The pole may be readily applied to cars employing the present device.

RESISTANCE.—Hugo Hellberger, Thalkirchen, Prussia, Germany. The resistance consists of a non-conducting backing or supporting-plate and a facing of metallic foil impressed upon or into the plate. The resistance in addition to solidity, simplicity, cheapness of construction, and compactness, offers the advantages of a high electric resistance and of the greatest possible heat-radiating capacity.

### Mechanical Devices.

KNITTING-MACHINE.—Max Saldin, 400 Wool Exchange, Manhattan, New York city. This inventor has devised an ingenous attachment for straight knitting-machines, by means of which mittens, sweaters, gloves, and other articles of wearing apparel can be knitted in such a manner that either single or separate tubular portions can be knitted at the same time. For example, in a mitten the wrist portion can be first knitted and then the thumb and finger portions, simultaneously, and properly spaced. In a sweater, the body can be knitted up to the sleeves, the two sleeves simultaneously, and finally the remaining body portion. The attachment has been in successful operation for several months.

WIRE STRETCHER.—James S. Smith, Beebe, Ark. The wire-stretcher comprises a lever pivoted between its ends. At one end of the lever stretching-hooks are pivotally connected, which are adapted at their free ends to engage the stretching-chain. A supporting guide-ring depends from the lever between the two stretching-hooks, through which the chain may freely pass. In addition to its usefulness as a wire-stretcher the invention will be found of service in stretching and splicing the separated ends of barbed wire.

BALING-PRESS FOR COTTON.—Morris R. Mitchell, Jonestown, Miss. The invention is applicable both to up and down packing, single and revolving presses, and to other presses to which it may be adapted. Its purpose is to weigh the lint as it is put in the press, by the pressure exerted by the tramper in forcing it down of up against the block or movable end piece, and by the consequent recession of the springs supporting the end piece. The operator is notified by the ringing of a bell, to stop the tramping when the desired weight of bale is secured.

WRENCH.—Guy L. Ray and William Peak, Ouray, Col. To the handle of the wrench a ratchet-ring is eccentrically pivoted, which ring is provided with circular series of teeth the opposite sides of which are radial to the pivot of the ring. Pawl devices engage the ratchet-ring and can be set to adjust the wrench to turn the head in either direction. The jaws slide radially in undercut seats in the head to adapt the wrench to different sizes of nuts or bolts.

MACHINE FOR CLEANING VEGETABLE FIBERS.—Manuel A. Torre, Merida, Mex. Connected with a scutching-wheel are peripherally-grooved disks arranged with their peripheries in register. Belts engage the grooves to hold the material. The scutching-wheel is caused to operate first on the lower part of the leaves and then on the upper part. The disks and belts are so arranged as to allow the upper and lower portions of the leaves to be brought successively into the path of the scutching-wheel.

STONE-SAWING MACHINE.—James S. Young, Barre, Vt. This improved stone-sawing machine is especially designed for sawing granite, marble, or other stone blocks used principally for monuments. The machine is arranged to cut the blocks in such a manner that the center portions become detached as solid blocks for use as monuments or other purposes. The machine also serves to make angular cuts. A number of saw-beams are pivoted at their ends to rock; and each carries a number of alined saws bodily movable transversely. The beams can be locked in position.

POLISHING DEVICE.—John B. Buchanan, Newark, N. J. The device is designed to clean metal buttons or similar ornaments, while still secured to the garment, without injury to the material. The device may be readily applied and locked in position around the garment, so that the polishing member of the device may be conveniently operated and carried into or out of engagement with the button, without interfering with the position of the body of the device.

COFFEE OR GRAIN MILL.—Charles U. Farrar, New Orleans, La. The mill comprises a casing in which grinding-wheels are mounted to rotate. One of the wheels is provided with a shaft; and the other has a hollow hub fitted to slide on the shaft. One wheel can be held non-rotatable relatively to the other. A nut rotatable in fixed bearings on the casing has right and left hand threads engaging corresponding threads on the shaft and hollow hub, whereby the grinding-wheels may be simultaneously adjusted toward and away from each other.

LIFTING JACK.—Levi C. Vickrey, South Bend, Wash. The object of the invention is to provide means for controlling the pawls upon lifting-jacks, so that they may be readily shifted to lift or lower the ram, or for freeing the pawls entirely from the ram. Two pawls are adapted to engage the teeth of the ram; and a spring acts upon both pawls to hold them in engagement with the ram. An adjustable controlling-lever and spring connections from the controlling-lever to the pawls are provided, whereby the action of the spring between the pawls may be neutralized.

### Miscellaneous Inventions.

APPARATUS FOR RAISING BITUMINOUS SAND FROM WELLS AND SEPARATING BITUMEN FROM ITS IMPURITIES.—Augustus S. Cooper, San Francisco, Cal. In drilling for oil, maltha-bearing sands are often encountered. The viscosity of the maltha is such that the tools soon become so thickly coated that they can no longer be operated. Generally the maltha superposed on a more liquid bitumen is too thick and viscous to pump; but even when it can be pumped so much fine grit is entangled within its sticky folds that the pumps are soon worn out. Previous methods for removing the maltha have been unsatisfactory and profitless. In this new process hot water is employed, whereby the viscous bitumen is rendered more liquid, so that it separates from its impurities. These impurities sink and the floating bitumen can be readily skimmed or decanted.

PUMP-VALVE STEM.—Perry S. Houghton, Lindsey, Pa. The stem is provided with a central rod for attachment to the valve-seats. On the rod are sleeves, each forming a bearing for a valve. A collar held on the rod is adapted to be seated on one of the valve-seats and to form a rest for the upper sleeve. The inventor states that the stem is not liable to bend or bind the valve in its opening; the wearing surface can be reversed to give long life to the stem.

CAN-OPENER.—George Robinson, Pahiatua, Wellington, New Zealand. The device can be applied to cans of different shapes and employed to seal the body hermetically to the top or cover. The can opener is made of one or more strands of wire and is so formed that when one of its exposed ends is grasped, it will be gradually detached from the can body and cover, and the two parts will be completely and cleanly separated.

EYEGLASS-CASE.—William M. Purdy, Manhattan, New York city. The purpose of this invention is to make a case of that kind which is open at one end, which is constructed mainly of flexible material, but which prevents bending upon transverse lines and serves to protect the clips. The outer walls of the case may be constructed of flexible leather, as in the ordinary case. But a core or stiffening-piece is inserted, which separates the two sides a sufficient distance to protect the clips and serves to prevent the case from bending and injuring the glasses.

GARMENT-FASTENER.—Arthur H. Lohse, Manhattan, New York city. This invention provides a simple means for securing the fastening device to a garment by the use of an anchoring-plate having teeth at its sides extended at an angle to the body of the plate. A keeper-plate at one end of the anchoring-plate is adapted to engage with the pin. A fastening device is provided for the anchoring-plate. The fastener can be secured to a garment without the use of thread.

BUGGY-TOP.—John C. Lambert, Tonica, Ill. By reason of the construction provided in this invention, the canopy or top of a buggy may be raised and lowered without reaching to the outside of the top. Merely by a rearward movement of his body, the occupant of the vehicle is enabled to drop the top or canopy. The attachment consists simply of a bar arranged to secure the top at its back portion, the bar being provided with side-arms pivotally connected with the middle joints of the side or main braces. By pressing upon the top-back, the bar will break the middle joints of the braces; and the top will then drop.

COMBINATION-TOOL.—William D. Arnot, Fitchburg, Mass. In the construction of this tool are combined a depth-gage, external or internal square, a caliper-gage, and a caliper-rule. All these parts are so compactly arranged that the entire tool can be carried in the pocket.

NEWSPAPER-FILE.—Philip C. Newbaker, Danville, Pa. The file has two strips laid loosely alongside each other and formed each with registering longitudinal grooves receiving the paper and with additional registering longitudinal grooves. A flat bar is mounted in the additional grooves and is adapted to be turned to spread the strips. U-shaped springs embrace the back edges of the strips adjacent to the additional grooves and serve to hold the strips firmly in engagement.

CURB-BIT.—William H. Aughey, Petroleum Center, Pa. The curb-bit is adapted for the use of both tender-mouthed and hard-bitted animals. The cheek-pieces of the bit are provided at their upper ring-sections with a central bar extending from the bottom of the ring to a point near the top. A curved cross-bar is attached to the upper portion of the ring-section and connected with the vertical bar. A segmental bar curved in an opposite direction to the cross-bar is connected therewith at the ends and also with the lower portion of the central cross-bar, forming thereby a segmental slot at one side of the ring which receives the nose-strap of a vicious horse. Great purchase can be obtained upon the mouth of the animal by reason of this construction.

STRING-PACKAGE.—James E. Beller, Auditor's Office, Treasury Department, Washington, D. C. The package is essentially composed of a number of independent and disconnected string rings, each of which partially overlies the preceding or adjacent ring so that there is always an overlying or uppermost ring which can be lifted and removed without disarranging the others. The package can be conveniently stored and shipped.

ASSAYING-FURNACE.—Orland W. Martin and Adolph J. Petter, Los Angeles, Cal. This combined assayer's furnace and muffle employs gaseous or vaporized fuel and requires but one burner for both the melting and cupeling chambers. The furnace is compact so as to be easily portable and is also adapted to rotate on a central pivot to permit firing at each end by means of one burner. The bottom of the smelting or crucible chamber is also made removable to facilitate cleaning the chamber and recovering bullion without the removal of any brickwork.

AXLE-LUBRICATOR.—Harmon D. Moïse, Sumter, S. C. The axle has its spindle provided with a longitudinal groove or channel. The inner end of the spindle has a reservoir fitted with a cover having a feed-opening and cap. Within the reservoir opposite the opening is a shoulder or bearing for the oil-feeding wick. A simple and novel construction is therefore provided to utilize capillary attraction in feeding the oil from the reservoir to the strip lying along the spindle.

HOG-CATCHER.—Josiah B. Herr, Norton, Kans. The hog-catcher consists of a hook composed of a length of wire twisted together. In connection with the hook a latch and cord are used. In operation the latch is opened and the hook is caught over the animal's leg; the latch is then closed by the cord, thus tightly grasping the leg and securely holding the animal.

CLOTHES-DRIER.—Bruno Kippels, Moorhead, Minn. Connected with a post having eyes in vertical alinement are a series of detachable, rectangular frame-sections, one of whose vertical bars has hooks and the other two eyes correspondingly arranged, whereby the sections are adapted for pivotal attachment to the post and to each other.

WRITING-CASE.—Richard M. Denzig, Elkhart, Ind. The writing-case is constructed to hold bills, letters, or documents. The cover automatically locks itself to the case when closed. When the cover is closed, the entire case resembles a book. The lock used is a simple form of keyless lock.

### Designs.

PILLOW-TOP.—Raffaello Astarita, Manhattan, New York city. This designer has secured patents for five novel pillow-tops which are noteworthy for the fineness of feeling displayed. The drawings accompanying the specification were made by the designer himself and are certainly striking examples of artistic designing as well as excellent draftsmanship.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## NEW BOOKS, ETC.

Geschichten vom Rhein. Erzaehlt von Menco Stern. New York, Cincinnati and Chicago: American Book Company. 1899. 12mo. Pp. 272.

No stream in Europe has figured so prominently in folk-lore or is of such historic interest as the River Rhine, and the legends which cling to it constitute an inexhaustible mine of material for German story writers. That Mr. Stern should have collected these tales for the use of his students in German, speaks well, both for his judgment as a teacher and as an author; for they are undoubtedly excellent material for conversation and composition in the classroom as well as of considerable interest to those who have traveled along the Rhine. The legends have been told with a certain delightful simplicity which impart to them a literary merit second only to their educational value.

A B C of Bee Culture. By A. I. Root. Revised by E. R. Root. Medina, Ohio: The A. I. Root Company. 1899. 8vo. Pp. 437. Price $1.25.

This is a veritable encyclopedia of everything relating to bee culture, and it has reached the unprecedented sale of 67,000 copies. The book is filled with illustrations showing every construction of hive and utensil used by the bee culturist. All terms are accurately defined and there are many illustrations of bee farms. It is a most interesting book even for those who are only indirectly interested in bee culture.

Journal and Proceedings of the Royal Society of New South Wales. Sydney, N. S. W. 1898. Pp. 268.

The volume is accompanied by a number of plates and is composed of various papers read by members of the society. It is interesting to note what is being done with science, in what we are apt to consider an out-of-the-way part of the world.

Laboratory Manual. Experiments to Illustrate the Elementary Principles of Chemistry. By H. W. Hillyer, Ph.D. New York: The Macmillan Company. 1899. Pp. 100; 100 blank pages.

This book is written for the use of college students of general chemistry. The experiments are admirably arranged. The directions are concise and the questions asked are reasonable and will tend to give the student an excellent idea of what modern chemical laboratory work really means.


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### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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**Minerals** sent for examination should be distinctly marked or labeled.

(7758) J. W. writes: 1. I have looked in vain in your Supplement catalogue (ed. of 1897) for a good illustrated article on the telegraph sounder. If there is such a Supplement or book giving a complete list, with illustrations, I should like to know it. A. We do not know where you can find a description of a telegraph sounder with directions for making it. It is a very old instrument. Call upon the local telegraph operator. He will doubtless allow you to examine and measure a sounder, and will tell you what wire it has upon it. You can then make one like it. 2. Can magnetism be refracted like light or sound? Is it possible to stop or at least considerably diminish its strength when made to pass through certain substances? Are there such substances? Which, if any? A. Magnetism has never been refracted like light. It is not supposed to be due to vibrations as light is, but to vortices in the ether of space. We are not prepared to say that it cannot be refracted. It is not possible to stop or diminish its strength. It is possible to put iron in the paths of the flow of the magnetism. The magnetic lines pass with greater ease through iron than through any other substance. They therefore leave the air or other substance and go into the iron. The space within the iron is found to contain no lines of magnetic force. Iron is the only substance which can do this.

(7759) E. R. A. writes: 1. I have started to make a 2-inch spark coil, primary wound with No. 14 wire and secondary of 2½ pounds of No. 36. Such a design is for a battery to work. I would like to know if I could not use a second primary over the first (that is the No. 14 wire) so as to use the coil on a 110 volt incandescent lamp circuit, with a Wehnelt interrupter, or use the battery at will. What size and how much wire will be necessary? A. In order to use a Wehnelt interrupter upon your coil you will not need a longer primary. If you need to make any change, it is to replace your primary with one wound with No. 12 or even No. 10 wire for either a battery or the higher voltage current of the street. No. 14 wire is rather small. You will need to wind two layers of wire for the primary. The Wehnelt interrupter is put into the circuit without other resistance. 2. Can you tell me where I can get some of the metal potassium for experimental purposes? A. The metal potassium can be had of any dealer in chemicals. A druggist would obtain it for you.

(7760) W. I. W. Co. ask: Could you inform us what the mixture is for zincs for potash batteries, the kind of acid they should be cleaned with, also where we can buy the mercury? A. The zinc for any battery may be either cast or rolled of a size to fit the jar selected. To amalgamate a zinc.—Take sulphuric acid and pour one gill into ten gills of water. Do not pour the water into the acid. Wash the zincs in this mixture with a cotton swab. Then rub mercury over the zinc till it is coated. If there is any trouble in making the mercury adhere, put the zinc into the acid wash again. You can buy mercury through any apothecary. Be careful to keep the mercury away from contact with anything except the zinc.

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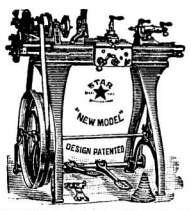

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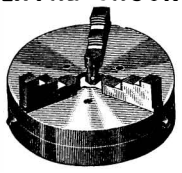

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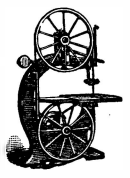

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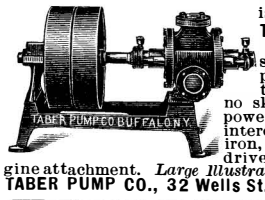


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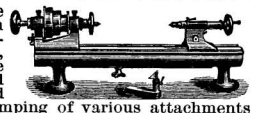

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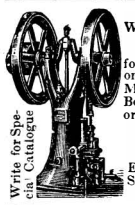

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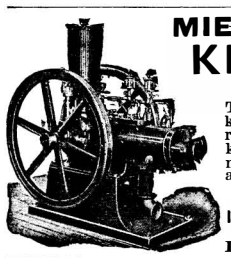

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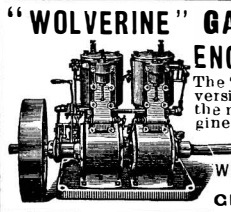

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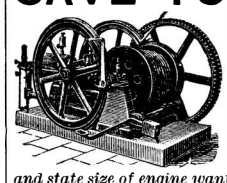

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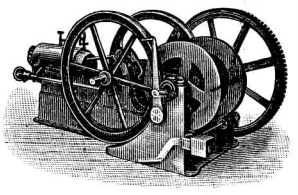

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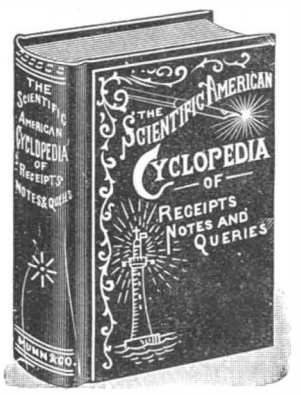


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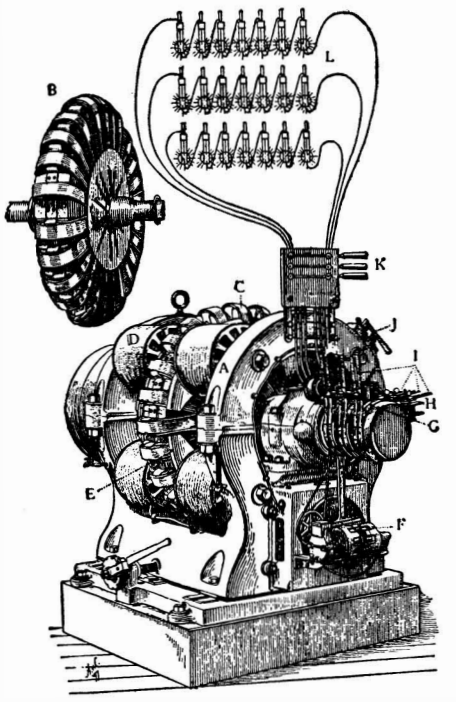


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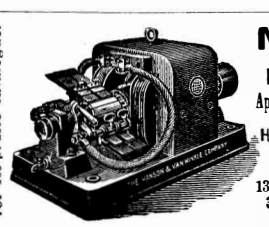

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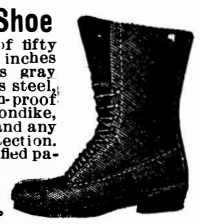

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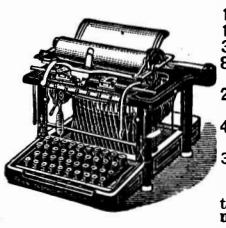

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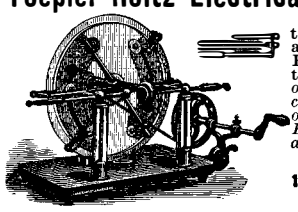

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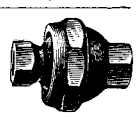

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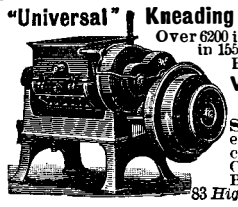

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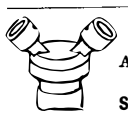

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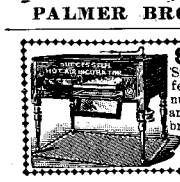

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**PROPOSALS.**

U. S. MILITARY GOVERNMENT OF PORTO RICO, Office of Board of Public Works, San Juan, Porto Rico, October 12, 1899. Sealed proposals for the building or reconstruction of about eighteen (18) miles of Road in the Island of Porto Rico will be received at this office until noon, December 23, 1899, and then publicly opened. Each proposal must be made in a prescribed form and be accompanied by a deposit of $1,000 in currency of the United States, or certified check of a National Bank, which will be immediately returned in the case of unsuccessful bidders. The Board reserves the right to reject any and all bids. It is estimated that the cost of the works will reach Two Hundred Thousand ($200,000) Dollars. For information apply to this office. W. V. JUDSON, Captain, Corps of Engineers, U. S. A., President Board of Public Works.

COMMISSION NEW EAST RIVER BRIDGE,
City of New York.

**NOTICE TO CONTRACTORS.**

November 9, 1899.

Proposals will be received by the Commissioners of the New East River Bridge, at their office, at No. 49 Chambers Street, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the 7TH DAY OF DECEMBER, 1899, endorsed "Proposal for Construction of Steel Cables, Suspenders, etc., of the New East River Bridge," for furnishing the materials for and constructing the steel cables, suspenders, cable bands, coverings, sheaves and their appurtenances of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be seen and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 13th day of November, 1899.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within ten months after the cable saddles are set in place upon the steel towers of the bridge.

Proposals will be made upon a form provided therefor, and only those proposals will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal in the office of the Commissioners, a certified check for $12,000, payable to the order of Julian D. Fairchild, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

The Contractor will be required to give a bond in the penal sum of $400,000, in the form annexed to the proposed form of contract, with an approved surety company doing business in the City of New York, conditioned for the prompt and faithful performance of the contract and its covenants and the work thereunder.

As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities which have been in successful operation on work of similar character for at least one year. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of such work at the present time.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any proposal offered.

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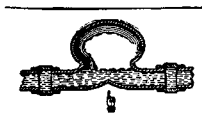

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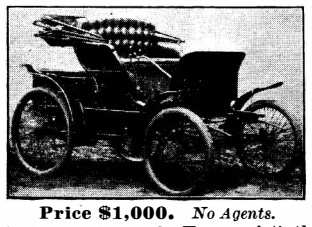

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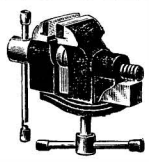

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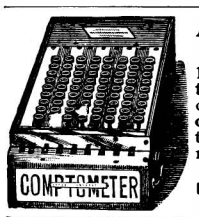


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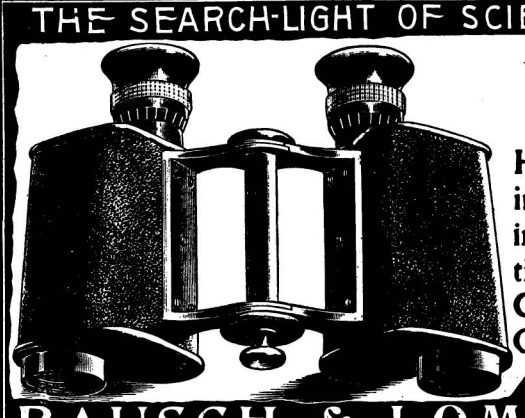

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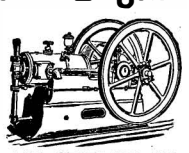

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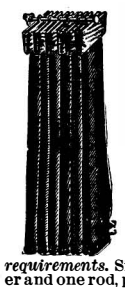

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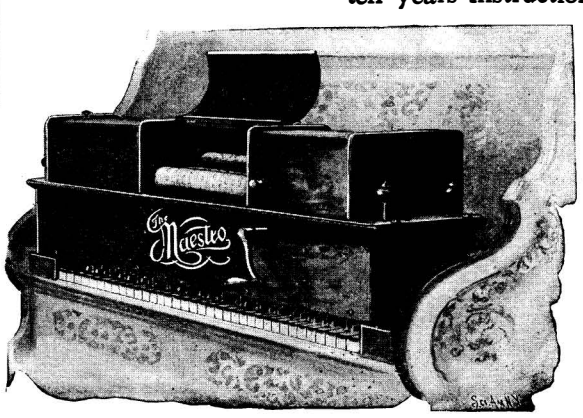


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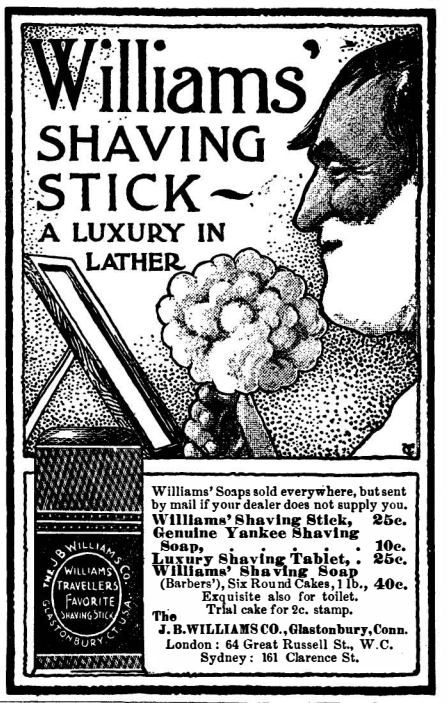


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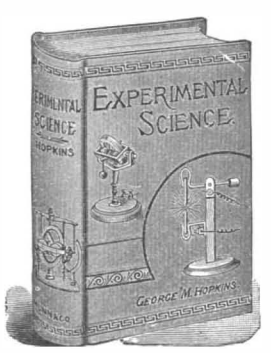


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